

NCHRP

REPORT 482

**NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM**

Guidelines for Selecting Compensatory Wetlands Mitigation Options

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NCHRP REPORT 482

Guidelines for Selecting Compensatory Wetlands Mitigation Options

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SUBJECT AREAS

Planning and Administration • Energy and Environment • Highway and Facility Design

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FOREWORD

*By Christopher Hedges
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This report presents guidance on selecting the most appropriate compensatory strategies to mitigate the effects of transportation projects on wetland habitats. Based on a comprehensive review of mitigation practices in the United States, the report discusses the advantages and disadvantages of various approaches and presents guidelines that an agency can use to select mitigation options that will have the greatest chance of success. Case studies are used to illustrate the process used by a number of state departments of transportation (DOTs) to mitigate unavoidable wetland losses. This report will be particularly helpful to transportation planners in state DOTs who have the responsibility of selecting or creating wetland mitigation options on a project-specific or statewide basis. In particular, this report outlines the steps necessary to develop a wetland banking program and provides examples of banking agreements used across the nation.

Wetland banking is one of the options for compensatory mitigation of unavoidable losses of wetlands as required by regulations established pursuant to Section 404 of the Clean Water Act. The Transportation Equity Act for the 21st Century (TEA-21) states that wetland banking will be given first consideration for mitigation of wetland losses due to Federal-Aid Highway projects. Federal agencies have published guidelines for establishment, use, and operation of mitigation banks. However, issues needed to be clarified and evaluated to ensure the most effective choice of mitigation options. Specifically, there has been no commonly accepted basis for selecting between small, dispersed mitigation options and consolidated mitigation options.

Under NCHRP Project 25-16, "Guidance for Selecting Compensatory Wetland Mitigation Options," a research team led by Anne Marble and Xavier Riva of A.D. Marble & Company developed guidelines for evaluating and selecting specific compensatory wetland mitigation options. The team evaluated the relative effectiveness of small, dispersed mitigation sites; consolidated mitigation sites; mitigation banks; and other compensatory mitigation strategies.

The team soon confirmed that there was no clear-cut formula to identify the ideal mitigation option for a given compensatory mitigation project. The available data on mitigation options tend to be incomplete and highly subjective. There are no clear indicators of whether consolidated mitigation works better than project-specific approaches in any given situation. In spite of a general perception that consolidated options offer better results, many states choose not to implement consolidated options because of real or perceived obstacles. Therefore, the authors use case studies to provide guidance on how a state DOT can select the mitigation strategies that will be most effective in the DOT's own situation. For states that wish to pursue consolidated mitigation options, the report discusses both obstacles and factors that are key to successful implementation. The team also discusses issues related to development of wetland banking agreements and outlines the steps involved in developing a banking agreement.

This report will be useful to state DOTs that are interested in developing a more proactive, long-term wetland mitigation program that includes wetland banking as one of the options.

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GUIDELINES FOR SELECTING COMPENSATORY WETLANDS MITIGATION OPTIONS

SUMMARY

Since the passage of the Transportation Equity Act for the 21st Century (TEA-21) in 1998, the volume of transportation projects being evaluated and designed has significantly increased. Over the past 3 years, funding for highway, bridge, and tunnel construction has steadily increased from \$30 billion to just over \$40 billion (Rubin et al. 2001). This 33% increase may rise further as more of the record \$198 billion surface transportation investments directed by TEA-21 is channeled into roadway projects. Paralleling this increase in roadway construction is a potential increase in the amount of impacts to the nation's wetlands and, subsequently, an increase in the number of wetland mitigation projects. Therefore, it is critical that information be distributed to the state departments of transportation (DOTs) to assist them in developing wetland mitigation programs that not only streamline the compensatory mitigation process, but also improve the quality of mitigation sites. This report will help DOT wetland managers to better understand the status of DOT mitigation programs across the United States, while also providing the necessary information to evaluate mitigation options and modify their respective programs to incorporate options that are appropriate for the mitigation demands.

This report summarizes the results of the National Cooperative Highway Research Program (NCHRP) Project 25-16, "Guidance for Selecting Compensatory Wetland Mitigation Options." This project was conducted in two phases. Phase I compares the success rates of the different wetland mitigation options. Phase II provides a decision-making tool to assist DOT wetland managers in developing comprehensive wetland mitigation programs that use multiple mitigation options. This objective was accomplished by illustrating the steps involved in developing a banking program, by developing eight case studies of state DOT wetland mitigation programs, and by evaluating existing banking agreements and guidelines.

Published in February 2001 as *NCHRP Research Results Digest 251* (NCHRP 2001), Phase I results showed that the data on the relative success of mitigation options are incomplete and highly subjective. Available data on wetland mitigation currently deal primarily with project-specific mitigation, not with consolidated mitigation or with a comparison of the two. The data have consistently illustrated the problems with project-specific mitigation, including sites not being built, problems with grading, insufficient

or excessive hydrology, incorrect plant communities, and large differences in the proposed and established mitigation types. No study has adequately investigated the success rate of consolidated mitigation or determined whether the procedures differ for establishing functioning project-specific and consolidated mitigation sites. The Phase I results also illustrated the following:

- Many state DOTs lack mitigation options.
- Inconsistencies in the quality and type of monitoring information collected by state DOTs make it impossible to determine whether the mitigation sites were actually successful.
- There is a perception that the success of project-specific and consolidated mitigation sites depend on better site selection, better coordination between designers and contractors, and more appropriate vegetation selection and planting techniques.
- There is a perception that consolidated mitigation offers more favorable results.

These results paralleled the recently completed National Research Council's (NRC's) Committee on Mitigating Wetland Losses report (2001), which stated that the committee could not compare the success of mitigation options: "such an approach would have required the committee to identify a single mitigation target ('or success criteria') and then determine which mechanism would most likely meet it. There simply was no data that could be used for such an assessment." The U.S. General Accounting Office's 2001 report on the effectiveness of in-lieu fee mitigation also found that U.S. Army Corps of Engineers (USACE) officials in 11 of 17 districts with fee-based mitigation programs believed that these programs were successful in mitigating wetland loss. The USACE officials maintained this belief despite having data that contradicted the belief (GAO 2001). These results demonstrated not only that there is a lack of data to compare mitigation options, but also that many resource agencies maintain the belief, despite a lack of scientific data, that consolidated mitigation is more successful than project-specific mitigation.

Phase I information helped to refine Phase II's objectives. The NCHRP Project 25-16 research panel agreed that Phase II objectives would be accomplished with the development of case studies of sample DOT wetland mitigation programs across the United States. These case studies focus on the history of selected wetland mitigation programs and their use of consolidated mitigation options, as well as the successes and problems of their programs. Information is also provided on the language of banking agreements and on the wetland banking development process to further assist in the understanding and development of a banking program.

It is anticipated that the information herein will provide guidance to state DOTs interested in expanding their mitigation programs to include consolidated mitigation options. The central issues regarding banking agreements are highlighted to provide the DOTs with an understanding about how a consensus can be built among resource agencies. Finally, it is hoped that this project will encourage DOTs to become more proactive in addressing their mitigation needs, to invest in consensus building among agencies, and to ultimately produce functional wetland mitigation projects whose benefits are maintained for the long term.

CHAPTER 1

BACKGROUND

Compensatory wetland mitigation is mandated by federal, state, and, in some cases, local legislation in an effort to stem the nation's loss of wetland habitat. The third step of the 404(b)(1) sequencing approach of the Clean Water Act (Memorandum of Agreement 1989) requires an applicant (in this case a DOT) to (1) attempt to avoid wetland impacts, (2) minimize impacts, and (3) mitigate the remaining impacts. Transportation projects often affect wetlands by altering surface flows, increasing sediment loading, removing vegetation, or reducing habitat. In many cases, 404(b)(1) guidelines will require compensation on-site or off-site of the unavoidable and minimized wetland impacts.

With the signing of the Transportation Equity Act for the 21st Century (TEA-21), President Clinton proposed a record \$218 billion (\$198 billion guaranteed for highway and transit funding) surface transportation investment over 6 years (USDOT 1998). The act responded to a desire not only to improve transportation safety with more funds for hazards elimination and education, but also to encourage economic growth with the construction and rehabilitation of bridges, roadways, and transit systems. Since the passage of TEA-21, transportation enhancements projects have been expected to increase by as much as 50%, a percent increase already realized in Oregon (FHWA 2001a).

It was clear that the increased volume of transportation projects could result in a corresponding increase in wetland impacts and mitigation projects. Therefore, TEA-21 created flexibility in the use of transportation funds and placed an emphasis on measures to improve the environment (FHWA 1998). This flexibility in funding enables state DOTs to address TEA-21's operating objectives to support broader long-term environmental goals and to avoid the most sensitive and environmentally fragile areas. With respect to wetland mitigation, TEA-21 encourages a broader watershed-based approach that uses wetland banking for mitigating unavoidable wetland impacts (FHWA 2000). Wetland mitigation banks implemented by state transportation agencies offer a unique opportunity to consolidate, manage, and protect wetlands resources more effectively while maintaining more workable alternatives for transportation and development (FHWA 1995a).

The concept of wetland compensation provides flexibility in the decision-making process by allowing development that is in the public interest to proceed while still protecting the

overall wetland resource base (Morgan and Roberts 1999). This flexibility has translated into an enormous disparity in the types of compensatory mitigation among state DOTs: from project-specific mitigation to consolidated mitigation; from wetland restoration to creation, enhancement, or preservation; and, finally, from in-kind mitigation to that of an entirely different wetland class. Regulatory agencies use the flexibility in compensatory mitigation decision making to select appropriate mitigation for transportation projects on an individual basis, employing a variety of options nationwide. For example, the preliminary findings of the Environmental Law Institute's wetland banking study (ELI 2001) reported that 42 states have active or pending wetland banks, although there are only 25 states with active DOT banks (Figure 1), and only 17 of 38 USACE districts had established in-lieu fee arrangements (GAO 2001), the majority of which are not used by state DOTs. This variability is also seen in the number of states with legislation authorizing the use of wetland banks. Currently, only 23 states legislate the use of banks (Figure 2).

STATE OF TRANSPORTATION WETLAND MITIGATION

Transportation agencies have a vested interest in compensatory wetland mitigation, specifically consolidated mitigation. The nature of most transportation projects is linear, often traversing streams, wetlands, and even watersheds. When projects involve direct or indirect impacts to these aquatic resources, in particular to wetlands, transportation agencies are obligated to provide compensatory mitigation after avoidance and minimization procedures have been implemented (see Glossary for 404(b)(1) Guidelines). Although on-site, in-kind mitigation for these impacts is the general priority, wetland managers maintain the belief that consolidating compensatory mitigation projects into one or more larger wetland projects allows for economies of scale in planning, implementation, and maintenance and helps reduce the risks associated with poor site selection, long-term management, and the attainment of lost wetland functions and values (Minnesota Department of Natural Resources 1998). This belief is recognized in the 1995 federal banking guidelines, which support banking when there exists "no practicable opportunity of on-site compensation or when use of a bank is environmentally



Figure 1. States with active banks.*



Arkansas - Arkansas Wetland Mitigation Bank Act, Ark. Code Ann. SS 15-22-1001 to 1012	New Jersey - New Jersey Freshwater Wetlands Protection Act, NJ Statutes Annotated SS 13:9B-13 to 15. NJ Administrative Code tit. 7, SS 143 & A-14.1 to 14.6
California - Sacramento-San Joaquin Valley Wetlands Mitigation Bank Act 1993, California Fish and Game Code SS 1775-1796	North Carolina - North Carolina General Statutes SS 143.214.8 to .11
Colorado - Colorado Rev. State. SS 37-85.5-101 to 111	North Dakota - North Dakota Cent. Code SS 61-32-05
Delaware - ERM DE Section II, D(10)(a)(6)	Ohio - Ohio Administrative Code SS 3745-1-54(D)(2)(6)
Florida - ch.373.4135-.4137, ch. 373.414, ch. 403.9332	Oregon - Oregon Wetlands Mitigation Bank Act of 1987, Oregon Revised Statutes SS 196.600-.665, Oregon Administrative Rules 141-085-0260 to -0650
Illinois - Interagency Wetland Policy Act 1989, 20 Illinois Compiled Annotated Statutes 830/1-1 to 830/4-1	Rhode Island - Rhode Island Environmental, Health & Safety Regulations, ERM RI SS 300.12(B)(11)
Kentucky - Kentucky Revised Statutes Annotated, 224.16.070(3)(d):. KY. Senate Bill 147	Tennessee - Tennessee Code Annotated, S 70-1-302(e)
Louisiana - State and Local Coastal Resources Management Act, Revised Statutes Annotated SS 49:214.41, Louisiana Administrative Code tit. 43, SS 724	Texas - Texas Natural Resources Codes Annotated S 221.001-.048, Texas Administrative Code SS 16.3 (c)(1)(E), SS 501.14(h)(1)(E), SS 501.14(h)(2)
Maine - Maine Revised Statutes Annotated, tit. 38, SS 724	Virginia - Virginia Code Annotated SS 28.21308, 33.1-223.21, SS 62.1-44.15:5
Maryland - Maryland Regulations Code tit. 26, SS 23.04.01 to .07	Washington - Washington Revised Code Annotated SS 47.12.330-.360
Minnesota- Minnesota State, Ann. SS 103G.2242, Minnesota Regulations 8420.0700-.0760	Wyoming -Wyoming Wetlands Act, Wyoming Statutes Annotated SS 53-11-308 to -311
Nebraska - Nebraska Revised Statutes SS 39-1320	

Figure adapted from Williams (2000).

Figure 2. States authorizing mitigation banks.

preferable to on-site compensation.” This support is also based on the premise that consolidation will facilitate compliance monitoring by regulatory agencies and will potentially fulfill the goal of no net loss of wetland functions by providing opportunities to compensate for authorized impacts when mitigation might not otherwise be appropriate or practicable (NRC 2001).

In 1998, Congress expressed its preference that mitigation banks be used to offset wetland impacts from federally funded transportation projects (NRC 2001). The FHWA has also continued to support the use of consolidated mitigation as a way to complete mitigation requirements in a more cost-effective and timely manner (FHWA 2001b). This support is reflected in TEA-21’s operating objectives to support broader long-term environmental goals that streamline mitigation projects. The act proposes the integration of watershed management principles and the identification and establishment of suitable areas for conservation banking as actions to address environmental goals and streamline transportation project implementation (FHWA 2000).

Ultimately, support for consolidated wetland mitigation options is about developing the flexibility to select the best wetland mitigation option for a given project with the goal of achieving no net loss of wetland functions and values. From this standpoint, NCHRP Project 25-16 was initiated to develop guidance for the selection of mitigation options, to evaluate the success rates of these options, and to provide a decision-making tool to assist state DOTs in the implementation of multiple mitigation options.

WETLAND MITIGATION OPTIONS AVAILABLE TO DOTs

Transportation agencies are constantly involved with construction projects that inevitably affect wetland areas, requiring permits to move through the regulatory process. Because the regulatory process can often be complicated and result in project delays, DOTs are interested in solutions that expedite the approval of projects with unavoidable wetland impacts. Wetland banking and in-lieu fee programs are potential solutions that can streamline the regulatory process by consolidating several mitigation projects into one. These solutions represent some of the mitigation options available to many state DOTs; however, regulatory agencies maintain that on-site, project-specific mitigation should be the priority. The following section highlights the types of mitigation options used by DOTs to satisfy their compensatory mitigation requirements.

Project-Specific Mitigation

Project-specific mitigation refers to the mitigation provided for one project. It is the most frequently used mitigation option by DOTs because the regulatory agencies typically recommend that on-site, in-kind, project-specific mitigation be the

first option so that the disturbed wetland can remain as close to its natural state as possible (Kruczynski 1990). If project-specific mitigation cannot be reasonably provided on-site, mitigation can be provided off-site or be consolidated into larger sites, such as banks or in-lieu fee mitigation areas.

Consolidated mitigation comes essentially in three forms: multiproject, nonadvanced mitigation; single-client banking; and third-party mitigation. The last form is a bank or an in-lieu fee program.

Multiproject, Nonadvanced Mitigation (also Known as Incremental Consolidation)

Multiproject, nonadvanced mitigation refers to mitigation of multiple impacts at one site, not necessarily at the same time. For example, if additional mitigation acreage is needed, the DOT may restore additional wetland acres by removing a berm created for a previous wetland project. Therefore, design and construction of the entire site may be completed in a piecemeal fashion without coordination among the different mitigation parcels. This option is not discussed further in the report because it does not require greater coordination between DOTs and resource agencies (e.g., state departments of environmental protection and the Environmental Protection Agency [EPA], the USACE, and the U.S. Fish and Wildlife Service [USFWS]) and because each mitigation parcel may be treated similarly to project-specific mitigation projects. Additionally, this option does not require greater consensus building among resource agencies, as do the following two consolidated mitigation options.

Single-Client Banking

The single-client banking option involves the creation, restoration, enhancement, or preservation of wetlands in advance of authorized impacts by the client for the client, sometimes for several years. An NRC report (2001) refers to this option as single-user mitigation banking. One of the most common examples of a single-client bank is that of transportation agencies performing large-scale mitigation for small linear fill necessitated by road build projects (Silverstein 1994). For example, several DOTs (e.g., California, Florida, Pennsylvania, Minnesota, Washington, and Wisconsin) have built their own wetland banks to compensate for anticipated transportation project impacts to wetlands in respective watersheds or DOT districts. Wetland banks offer an opportunity to consolidate mitigation projects, saving time and money on design, construction, and monitoring that otherwise would have been apportioned on many smaller sites. Because these banks are still owned by the DOT, legal responsibility to monitor and maintain these sites still resides with the transportation agency. Single-client banking requires the DOT to develop a consensus with the agencies regarding all aspects of banking, which are outlined in a memorandum of agree-

ment (MOA) or an umbrella agreement, which is drafted by the mitigation banking review team (MBRT).

Third-Party Mitigation

Third-party mitigation refers to mitigation performed by an entity other than the permit recipient (NRC 2001). With respect to DOTs, this option refers to mitigation, in the form of either a wetland bank or a fee-based program, in which another party provides payment for mitigation at an amount determined by the extent of the wetland impact. When on-site, project-specific mitigation is not appropriate or feasible, payments to a third-party bank or an in-lieu fee program are often the simplest and most preferred option for DOTs, as time and money are not spent on design, construction, or maintenance of the sites.

Resource agencies have often been reluctant to allow DOTs to use this option. During followup interviews, resource agency personnel expressed the opinion that DOTs should provide their own mitigation because they have the financial means to establish sites. Also, many resource agency personnel believed that in-lieu fee programs and private banks were established to provide cost-effective mitigation for developers and homeowners who do not have the means to develop wetland mitigation sites. However, several state DOTs have

taken full advantage of third-party mitigation options. For example, the Ohio Department of Transportation (ODOT) has purchased many credits from the Ohio Wetlands Foundation's mitigation banks. In one case, it purchased 40 credits in advance of known impacts (Linkous 2000). The Louisiana Department of Transportation and Development (DOTD) has also purchased credits from the state's 35 approved banks to provide compensation for approximately 50% of their mitigation projects and will continue to use third-party banking for future mitigation needs (Deshotel 2001). Florida's banking guidelines maintain a preference for banks. The Florida water management districts (WMDs), which manage much of the Florida Department of Transportation's (FDOT's) mitigation, continue to purchase credits from third-party banks when wetland impacts are located in bank service areas.

With respect to in-lieu fee programs, only FDOT and the North Carolina Department of Transportation (NCDOT) are using in-lieu fee programs to a significant extent. For example, the St. John's River Water Management District (SJRWMD) in Florida applies fees toward 14 ongoing mitigation preservation projects, while the South Florida Water Management District (SFWMD) uses fees to assist in the implementation of the Save Our Rivers program (ELI 2001). As of April 2001, NCDOT had provided approximately \$18 million to the Wetland Restoration Program for various mitigation projects and had an agreement with the program to use it for future projects in 11 designated watersheds (Schiller 2001).

CHAPTER 2

RESEARCH METHODOLOGY

The purpose of this research was to determine which states, their respective DOTs, and environmental agencies perform compensatory wetland mitigation; which options they currently pursue; and whether they have been successful in their wetland compensation. The approach involved a database, literature, and Internet search; a transportation and resource agency survey; and telephone and personal interviews.

Phase I research entailed a detailed literature, Internet, and database search for information on mitigation banks, data sources, and contacts. This search required the review of websites and the review of records from resource agencies (e.g., the EPA, the USACE, and the USFWS) and state environmental agencies and from private wetland organizations. Research of current wetland literature was also completed in order to determine the prevailing nationwide sentiment about wetland mitigation. Finally, the research involved the review of recent mitigation studies prepared by the state DOTs, the USFWS, the USACE, and private banking entities.

The second step completed during Phase I was the development of an agency survey. Copies of this survey were sent to all state DOTs, as well as federal and state environmental agencies, and private banking entities. The content of the survey reflected the project's objectives to determine whether states pursued the consolidated mitigation option, what the overall trend has been in satisfying wetland permit requirements, and what information has aided in the compliance with mitigation permitting. The survey also helped identify key contacts for the telephone and personal interviews conducted in Phase II.

Of the 142 surveys distributed to all the state DOTs, federal and state resource agencies, and private banking entities, 55 surveys were returned. Seventy-six percent (38 of 50) of all state DOTs provided survey responses. Completed surveys were also received from such private entities as Florida Wetlandsbank, Inc.; Mile High Wetlands Bank; Critical Habitats, Inc.; the Walt Disney Company; Marsh Resources; and Ecology and the Environment. Surveys were also completed by the San Francisco and Baltimore USACE districts, as well as the state environmental agencies of Iowa, Indiana, Minnesota, Ohio, Washington, and Wyoming. The data compiled from the survey were subsequently arranged in spreadsheets, and figures were created to illustrate the overall responses.

The final process (Phase II) was to contact all key respondents in order to develop a more accurate picture of wetland mitigation throughout the United States and to develop eight case studies of state DOT mitigation programs. The states selected were California, Florida, Louisiana, Maine, North Carolina, Pennsylvania, Washington, and Wisconsin. This selection was based on spatial distribution in the United States and diversity of mitigation options employed. Ten states were also included in a comparison of banking agreements to provide a comprehensive summary of banking issues and their resolution with respect to the federal banking guidance issued in 1995. Telephone and personal interviews were made to collect relevant information on these banking agreements and bank programs. A series of questions was drafted in order to standardize the interviews.

CHAPTER 3

PHASE I RESULTS

PERMIT REQUIREMENTS AND AGENCY INPUT

Permit requirements are the conditions that must be met by a wetland mitigation project before it is deemed successful. The requirements are usually tied to a desired wetland function, and they are used to evaluate whether the mitigation site is performing according to a desired trajectory. For example, a permit requirement may require a 75% vegetative cover or plant survivorship after the first growing season. This particular requirement is used to determine whether the mitigation site can sustain the desired wetland vegetation, indicating whether contractors have established the appropriate hydrologic and soil conditions. These requirements enable the resource agencies to translate their mitigation goals into an evaluation system for determining whether a mitigation site has been successful.

Permit requirements often vary among states, largely because of environmental constraints and federal agency personnel, but also because of the differing environmental management goals of the state agencies (e.g., creating wildlife habitat or forested wetlands). The survey conducted in this project asked respondents to indicate the most typical federal, state, and local wetland permit requirements for compensatory mitigation projects (Figure 3). The responses indicated that the most common permit requirements are that the site be monitored, have an established wetland acreage, have an established plant survivorship (for example, at least 50% survival of planted woody species), and meet specific hydrology criteria. The responses also indicated that permits requiring a specific percentage of canopy coverage or a specific type of wetland vegetation planted were not typical for most states. Some respondents also indicated that the removal or reduction of exotic species and the incorporation of an upland buffer were required by some state agencies.

The survey also asked wetland managers which agencies, other than permit agencies, had input on site selection or design for both consolidated and project-specific mitigation projects (Figure 4). Eighty percent of the responses indicated that the USFWS, the EPA, and the state fish-and-game entities all provided input into the DOT mitigation process. A much smaller percentage of state DOTs were given guidance from the U.S. Department of Agriculture (USDA), natural heritage programs, and nonprofit organizations like the Nature Conservancy. Coastal states indicated that they received additional

input from the National Marine Fisheries, state departments of marine resources, and local coastal districts.

SUCCESS OF WETLAND MITIGATION TYPES AND CLASSES

Wetland Types

Wetland type refers to the type of mitigation developed. Examples of wetland mitigation types include creation, restoration, enhancement, and preservation. These terms are defined as follows:

- *Creation* is the establishment of wetlands (or another aquatic resource) that did not formerly exist. Creation can involve engineering of hydrology and soils (Federal Register 1995, Mitsch and Gosselink 1993).
- *Restoration* involves the rehabilitation or reestablishment of wetlands (and/or other aquatic resource characteristics and functions) at a site that may be degraded or hydrologically altered. Restoration often involves reestablishing the vegetation (Federal Register 1995, Mitsch and Gosselink 1993).
- *Enhancement* involves improving the structure or increasing one or more aquatic functions of an already existing wetland (Federal Register 1995, Middleton 1999).
- *Preservation* (often called conservation or protection) is the removal of a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. Preservation may involve the protection of upland areas adjacent to wetlands as necessary to ensure protection and/or enhancement of the aquatic ecosystem. (EPA 2001, Federal Register 1995)

Determining the most effective type of mitigation largely depends on each state's mitigation priority. The survey and subsequent interviews indicated that restoration mitigation was most often encouraged and resulted in the greatest likelihood of success. Restoration mitigation grew out of the efforts to bring back Midwestern prairies (Jordan 1981), and the aim, according to the NRC's Committee on Restoration of Aquatic Ecosystems, "is to emulate a natural, functioning self-regulating system that is integrated with the ecological landscape in which it occurs" (NRC 1992). For example,

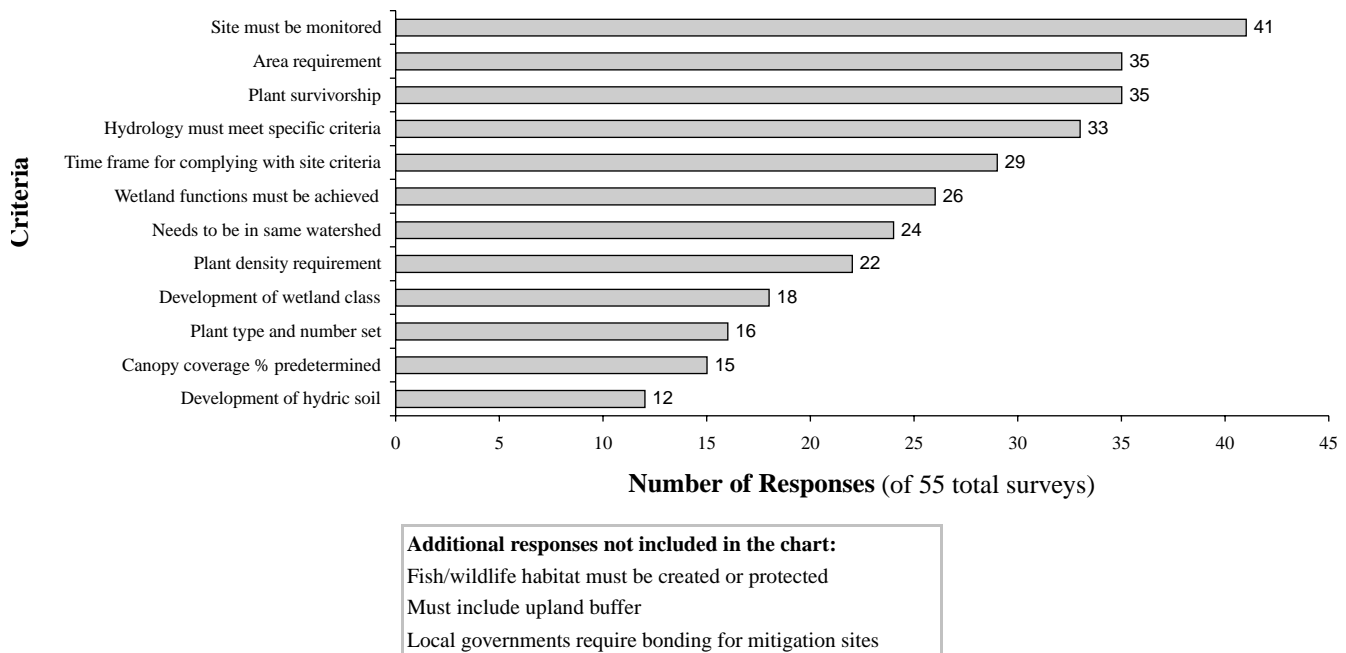


Figure 3. Survey responses: What are typical federal, state, and local permit requirements for your mitigation site?

instead of having to create wetland characteristics out of uplands, managers can restore previous hydrological conditions or add appropriate wetland plantings to agricultural land that once existed as wetland. Although wetland creation and enhancement are still used, most DOTs pursue wetland restoration projects, integrating wetland enhancement and preservation whenever possible. The argument for wetland restoration is that restoration ultimately limits the number of potential problems associated with compensatory mitigation, such as a lack of appropriate hydrology.

A Minnesota Department of Natural Resources study (1998) and a study of Maine's wetland mitigation program (Woodlot Alternatives, Inc., 1996) both recommended that creation mitigation be used as a last resort and encouraged a greater use of restoration for project-specific mitigation. Specifically, those studies promoted the restoration of previously drained wetlands rather than creating wetlands, especially when the projects will affect high-quality or scarce natural upland features.

Wetland Classes

Wetland Classes refers to a classification system that describes wetlands with respect to their location or origin and the type of vegetation or substrate found in the wetland. Examples of wetland classes include palustrine emergent persistent wetlands (Cowardin classification system [Cowardin et al. 1979]) and depressional wetlands (hydrogeomorphic [HGM] classification system [Brinson 1993]).

Like the selection of wetland types, wetland class selection depends on a state's mitigation priority. Some states are

encouraged by resource agencies to mitigate for only one particular class, regardless of which wetland class is impacted, in an effort to restore unique or significant wetlands. For example, Kentucky and Tennessee policies encourage compensatory mitigation of forested wetlands over other classes. Class selection also depends on site selection, topography, and diversity of wetland habitats within the state. The survey asked DOTs and resource agencies which wetland classes, using the Cowardin and HGM classification systems, were most successfully mitigated.

Cowardin Classification System

The survey results indicated that the emergent and open-water wetlands were most successfully mitigated in palustrine, estuarine, and lacustrine systems. With palustrine and estuarine systems, forested wetlands were the least successfully mitigated. The survey data suggested that palustrine and lacustrine emergent and open-water wetlands were the easiest to mitigate because of the flexibility and variability in grading for emergent and open-water wetlands. Palustrine and lacustrine wetlands are commonly created in conjunction with each other because emergent vegetation can tolerate different levels of inundation. If grading has created deep areas, the emergent vegetation can still adapt to the shoreline and shallower areas. In contrast, forested wetlands require more precision in grading and more time to develop. Saplings may not be able to tolerate the fluctuations in hydrology tolerated by mature trees. Furthermore, forested wetlands may require 50 to 100 years to fully mature, which

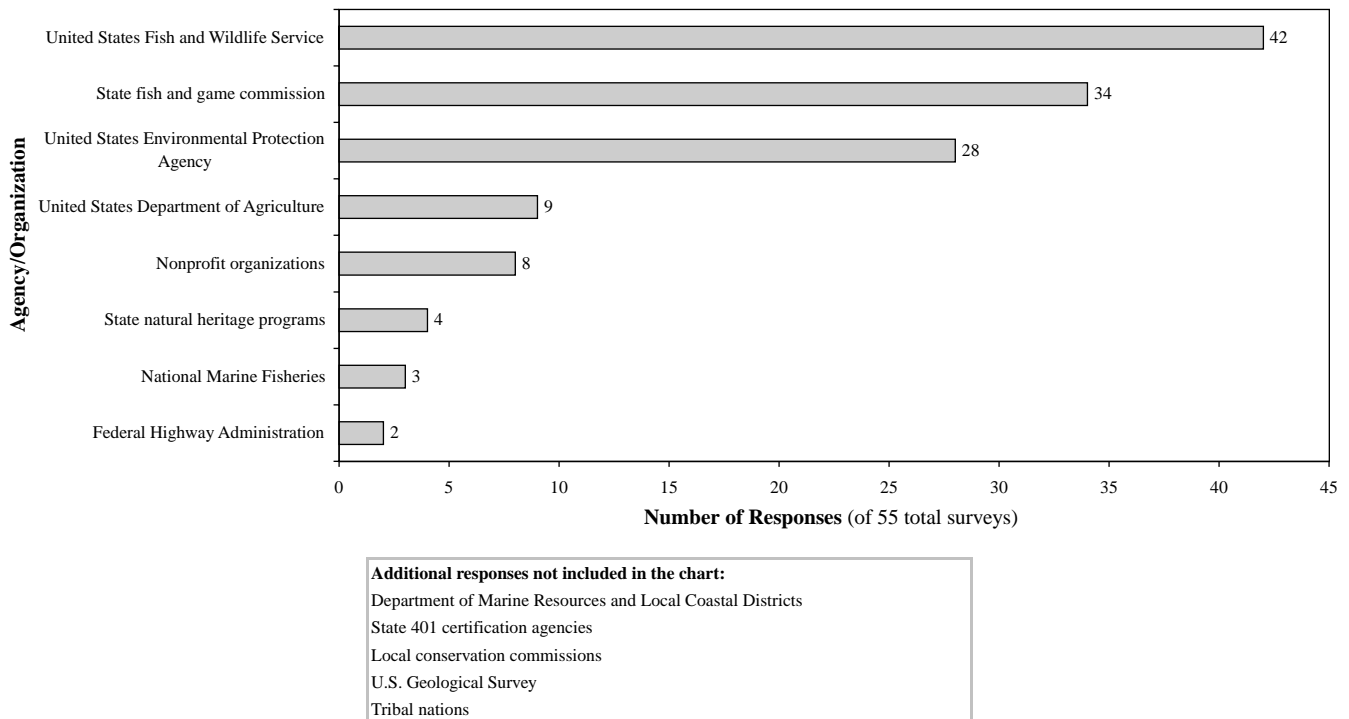


Figure 4. Survey responses: Which agencies, other than permit agencies, have input on site selection or design for mitigation projects?

makes it difficult to know if any given site will ultimately be successful. No conclusive statement can be made for marine and tidally influenced wetlands because of the scarcity of responses for these classes. This scarcity possibly results from limited opportunities for mitigation in these classes and/or poor survey feedback.

Hydrogeomorphic Classification (HGM)

Because the use of the HGM classification system is less prevalent, only 30 responses refer to this system. Many of these responses (i.e., 43%, or 13 of 30) indicated that mitigation with depressional (e.g., pothole) wetlands was most successful. Riverine and estuarine fringe wetlands were also indicated as being viable mitigation options, with six and four responses, respectively.

FACTORS INFLUENCING THE SUCCESS OF PROJECT-SPECIFIC AND CONSOLIDATED MITIGATION

Phase I literature research revealed that little data exist to compare the success rates of project-specific and consolidated mitigation options. Although several studies evaluated project-specific mitigation efforts within states or federal agency regions (Johnson et al. 2000, USFWS 1998, Gwin

and Kentula 1990), they did not focus on the transportation industry. To address this need, the agency survey specifically targeted DOT wetland managers across the United States for their experiences with wetland mitigation options.

Project-Specific Mitigation

Support for on-site, project-specific mitigation is driven by the perception that lost functions and values are best mitigated close to the impact, usually within the same watershed, as well as the belief that on-site mitigation is more practical. That perception is rooted in watershed-based management, which emphasizes the need to preserve the overall flood flow, nutrient removal, and storage capacity functions, as well as the wildlife habitat values, within each watershed. These individual, often small compensatory wetlands (i.e., 2 acres or smaller) may appear to provide little function, but are actually important components of the larger natural system (Trochlell and Bernthal 1998). For example, small wetlands are critical to waterfowl, reptiles, and amphibians, thus providing a diversity and abundance of food resources and a viable habitat.

Support for project-specific mitigation can also be justified for practical reasons: Project-specific mitigation sites can be cost-effective when created adjacent to road construction, as construction equipment is already present in the project area. Project-specific mitigation sites can also use areas where fill has been borrowed, spreading the cost of wetland creation

between road construction needs and wetland grading. DOTs mentioned in their survey responses that the often lengthy and complicated process of developing a consensus on mitigation banking, and subsequently drafting a banking instrument, made project-specific mitigation a more efficient, less restrictive process.

Successful wetland mitigation is a product of having appropriate hydrology, vegetative communities, and soil types that predominately characterize a wetland community. For these three wetland components to exist, however, good planning, design, and site maintenance must be present. State DOTs and resource agencies indicated that the three most important reasons for the success of their project-specific mitigation sites were appropriate hydrology for the site; good coordination among designer, agency, and contractor; and appropriate site grading (Figure 5). The respondents also indicated that using appropriate planting techniques and understanding hydroperiods and appropriate plant elevations were critical to wetland mitigation success. Controlling animal predation, having good seed germination, and using a good nutrient fertilization program were not seen by many of the respondents as critical to the success of project-specific compensatory mitigation.

The survey also asked respondents to identify problems with establishing individual wetland mitigation sites (Figure 6). Respondents indicated that insufficient hydrology and poor site selection were the most common problems with their mitigation sites. They also indicated that invasive plants and a lack of necessary training or skill of contractors and designers often resulted in problems. Survey options like vandalism, poor soil attributes (i.e., chemical composition), problems with physical structures (e.g., culverts and berms), and improper planting techniques were rarely selected.

Consolidated Mitigation

An increasing number of states have begun using consolidated wetland mitigation to streamline the mitigation process and to potentially improve wetland mitigation quality. Studies (Gwin and Kentula 1990, USFWS 1998, Mockler 1998) often criticize individual mitigation sites as being inadequately designed and constructed and providing little compensation for the lost wetland function or value. The survey and subsequent interviews asked DOTs and resource managers of other agencies whether they used project-specific or consolidated mitigation and why the mitigation sites suc-

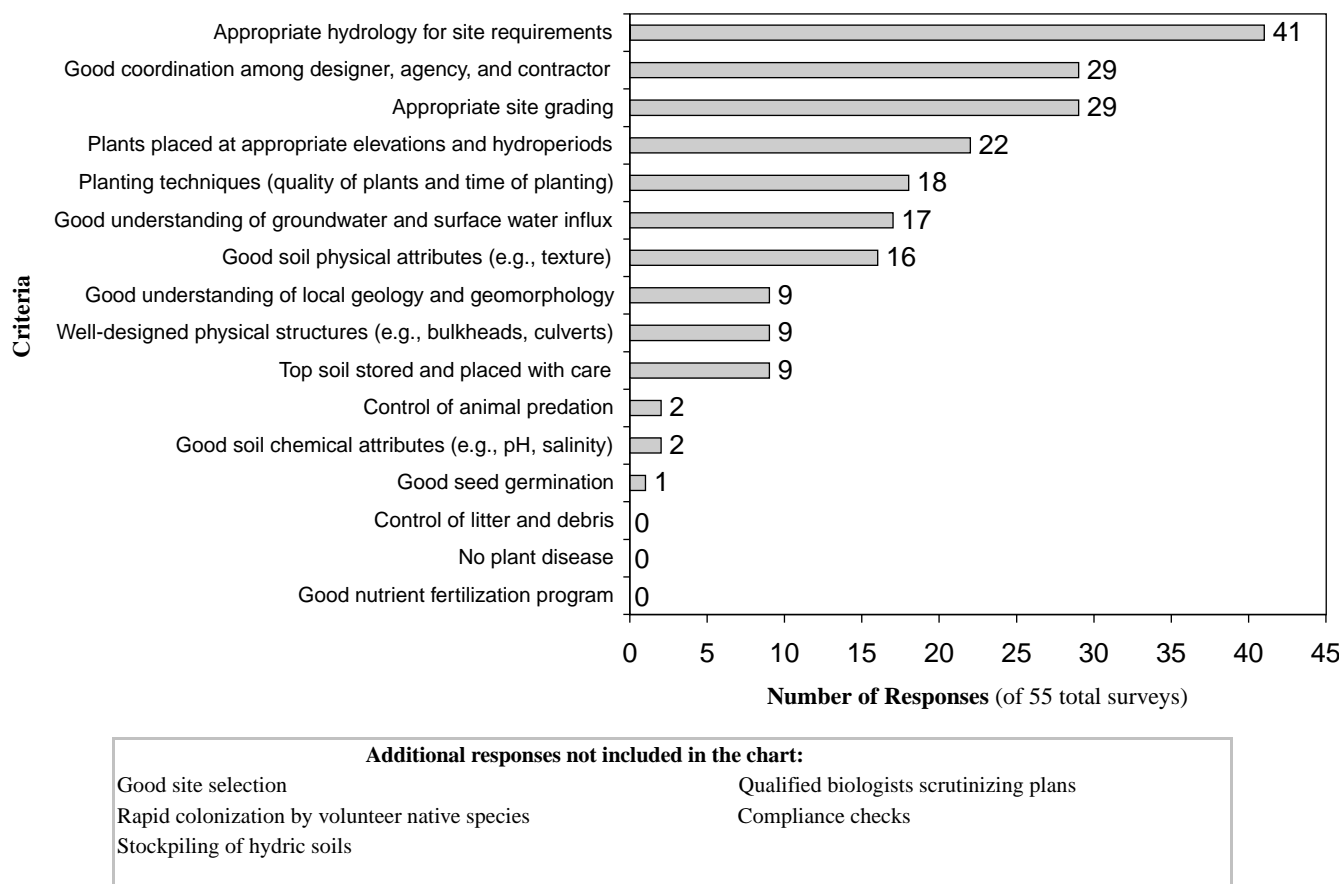


Figure 5. Survey responses: What are reasons for successful project-specific mitigation sites?

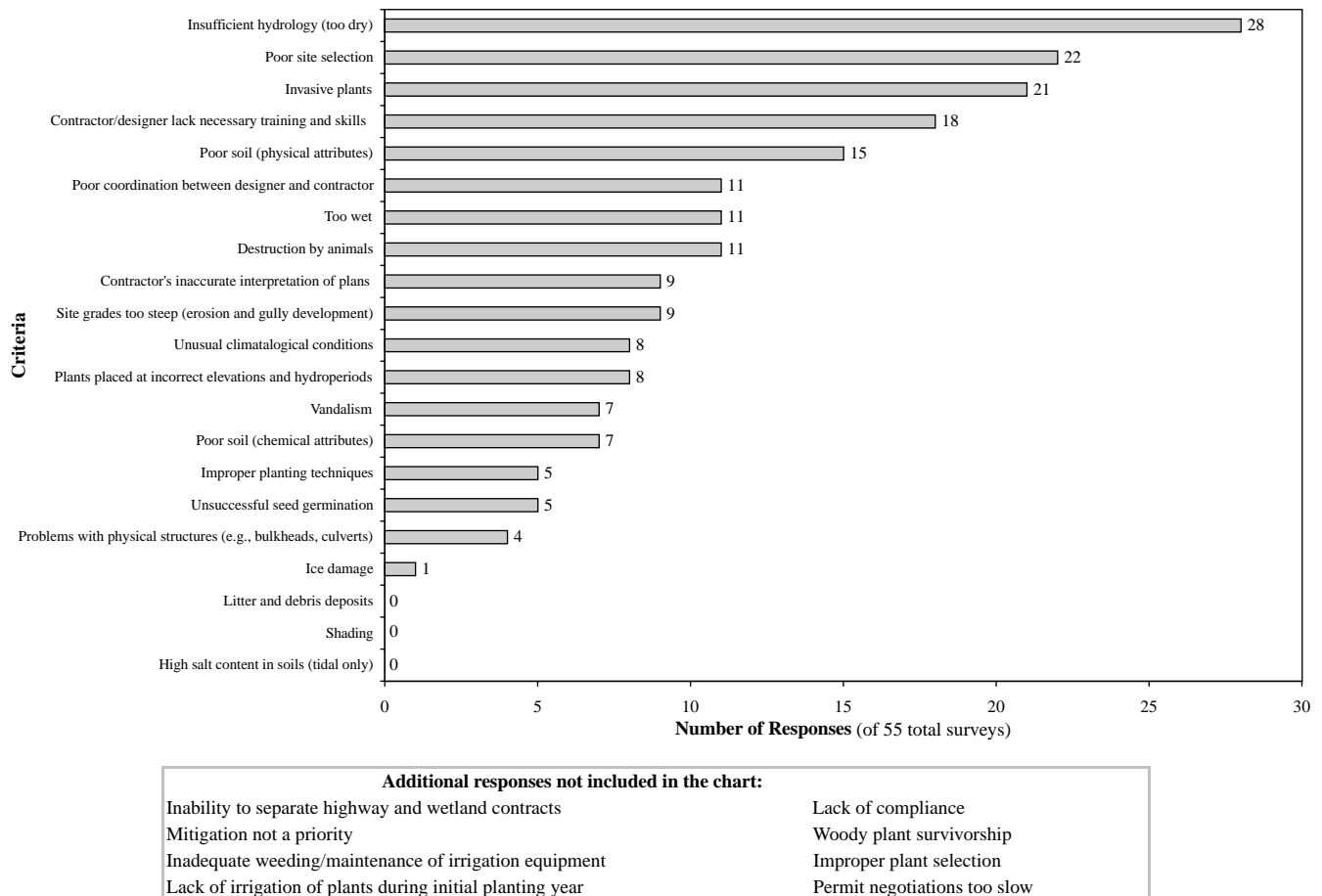


Figure 6. Survey responses: What are problems with establishing project-specific mitigation sites?

ceeded or failed. The results inform DOTs and resource agencies about the essential factors affecting successful wetland mitigation.

The survey also asked respondents which reasons were most responsible for the success of or problems with their consolidated mitigation sites (e.g., banks and in-lieu fee programs) (Figures 7 and 8). Three of the four most common reasons for the success of these consolidated sites paralleled those for the success of the project-specific sites: appropriate hydrology, good coordination, and appropriate site grading. The most popular option for consolidated sites, good site selection, was not an option offered for individual sites. Good soil attributes and planting techniques were also identified as important reasons for the success of consolidated mitigation. Respondents remarked that incorporating natural areas, adequately funding maintenance and monitoring activities, and coordinating between state and federal agencies also contributed to successful consolidated mitigation.

Most responses to the question about which reasons were most often responsible for the problems with or failure of consolidated mitigation resembled the answers given for individual sites. Insufficient hydrology, extreme dryness, and invasive plants were the top responses (24%), while inappro-

priate planting elevations, hydroperiods, and poor coordination between designers and contractors were also frequently cited. Destruction by animals or humans, excessively steep grades, and problems with physical structures were rarely cited as reasons for problems with consolidated mitigation. Wetland managers also provided several reasons unique to consolidated sites for the failure of those wetland sites: low-bid process, lack of compliance, lack of coordination and understanding of credit evaluation systems, and too much site disturbance.

Keys to Mitigation Success and Failure

Analyzing the Phase I agency survey data illustrates two important points about the success and failure of mitigation options. First, success of wetland mitigation largely depends on the communication and management between the designer and the contractor. If mitigation goals and site design are not properly translated by the manager to the builder, then the site, regardless of mitigation option, will likely fail. For example, the most common reason for the failure of early banks was related to improper design or engineering of hydrology (Brumbaugh 1995). Survey responses emphasized that success

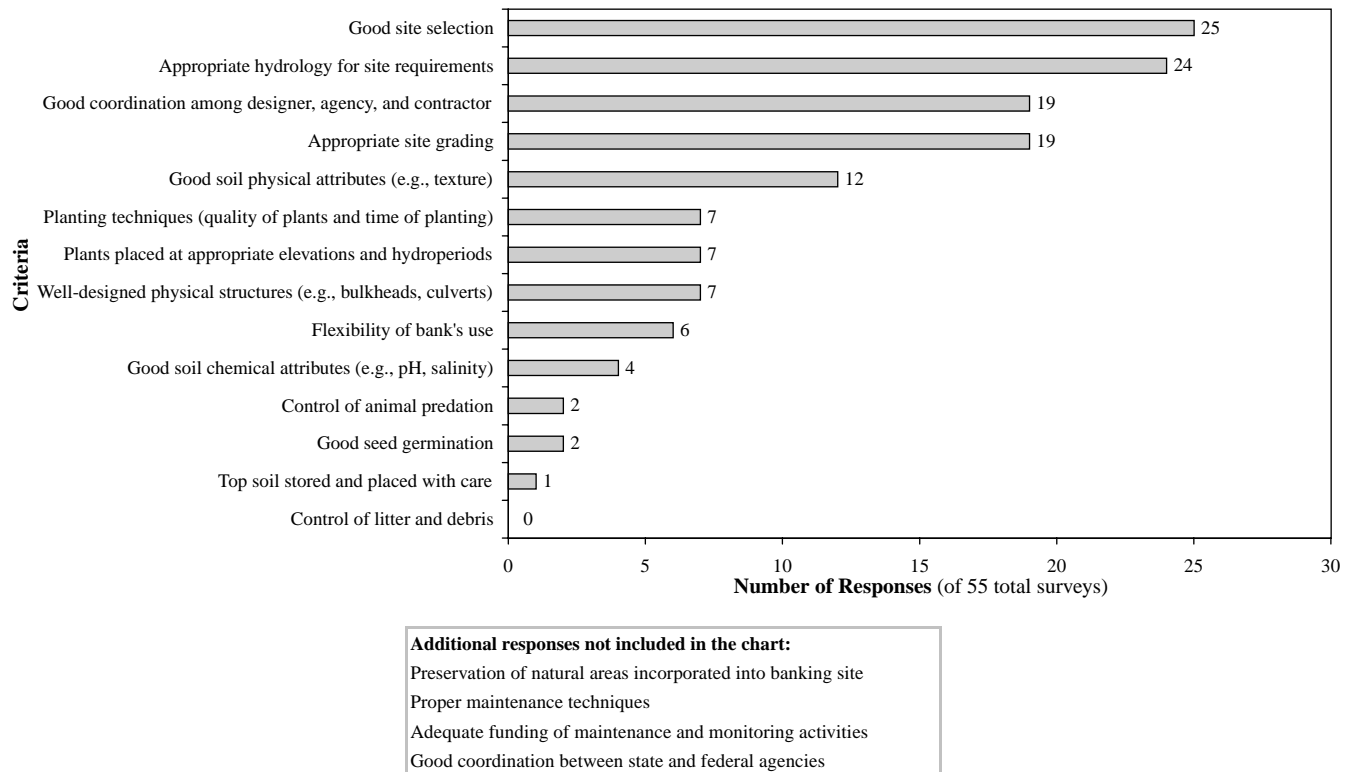


Figure 7. Survey responses: What are reasons for successful consolidated mitigation sites?

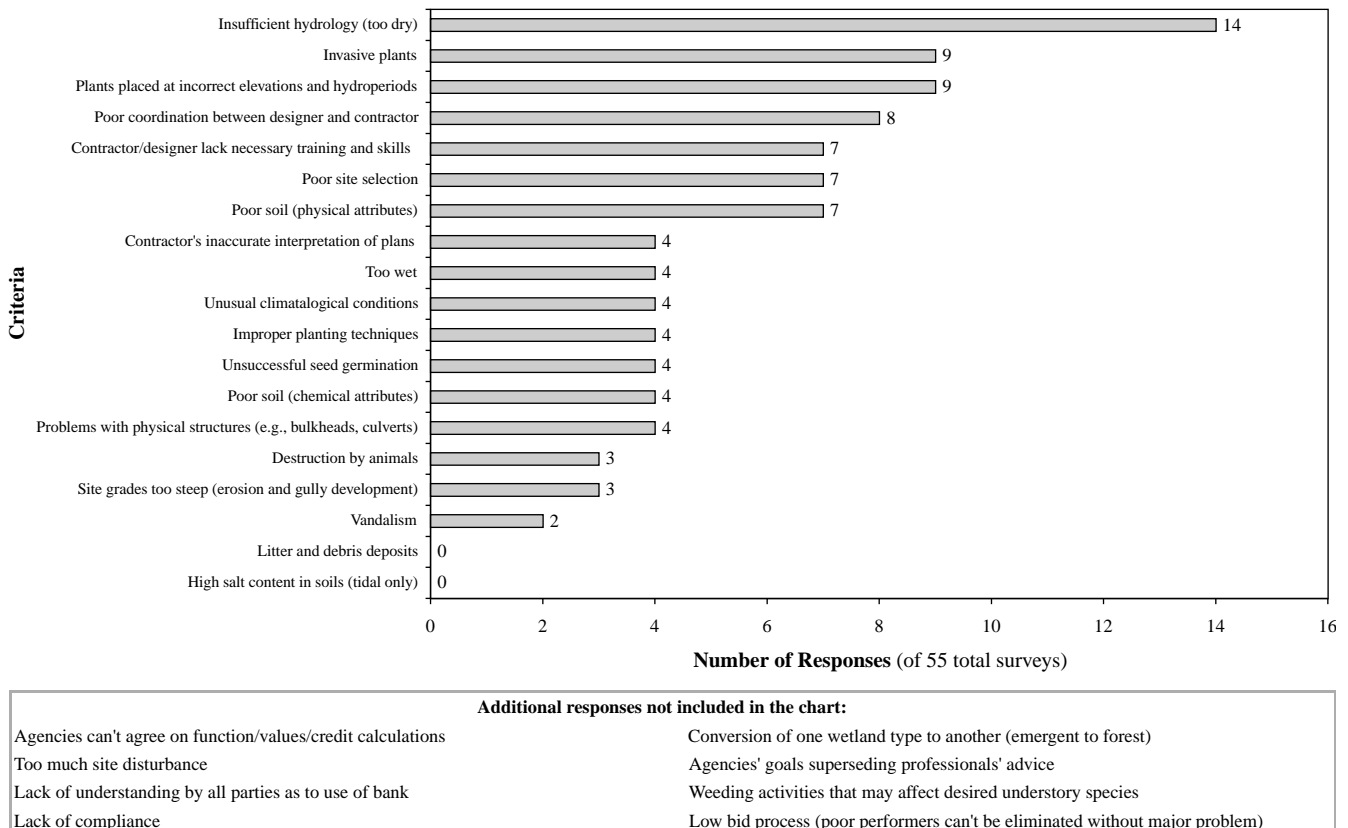


Figure 8. Survey responses: What are problems with establishing consolidated mitigation sites?

and failure depend on selecting good sites, having adequate hydrology, and using appropriate planting techniques.

The second point is related to the expertise of the contractor in understanding wetland construction. Successful wetland mitigation often requires stricter grading plans and more precise planting techniques. Some survey respondents indicated that the most effective approach was a “design-build” process, in which experienced wetland contractors handled the mitigation project, under the direction of the designer, separately from the highway project.

Lack of Mitigation Options

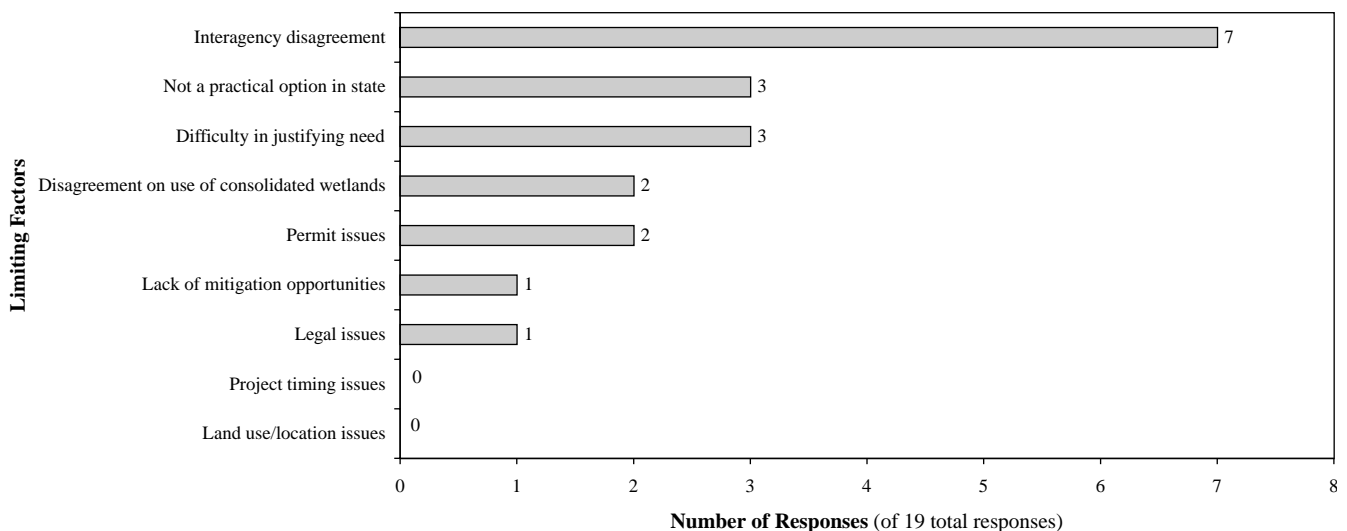
Not all states have been able to establish mitigation banks or other consolidated mitigation options, such as in-lieu fee

programs. One of the intentions of the agency survey was determining whether states have banks and, if not, why not. Seventy-six percent of respondents indicated that their states have consolidated sites, with 42% of respondents adding that they believed consolidation provided the greatest benefits (Table 1). An additional 15% believed that the benefits of mitigation options, consolidated or project-specific, depended on the project, while 5% favored project-specific mitigation. When asked which mitigation option provided the greatest benefits, 36% of respondents did not respond to the question.

When asked why consolidated mitigation was not used in their state, survey respondents most frequently (37%) cited interagency disagreement as the biggest obstacle (Figure 9). An additional 21% indicated, more specifically, that disagreement

TABLE 1 Survey responses: Which mitigation option provides the greatest benefits?

Responses	# of Responses	% of Total
Consolidated	23	42
Project-Specific	3	5
Depends on the Project	8	15
Not Enough Experience to Compare	1	2
No Response Given	20	36
Total	55	100



Additional responses:
 Agencies have not identified good opportunities
 Funding has not commenced
 Intransigence of resource agencies regarding assigning credit
 Proposals drafted, still no approval
 Resistance to investing transportation funding

Figure 9. Survey responses: Why is consolidated mitigation not used in your state?

on the use of consolidated wetlands and permit issues were reasons why their state was unable to develop mitigation banks or other forms of consolidated mitigation. Other responses stated that consolidation was an impractical option or that state DOTs were unwilling to invest funds into consolidation. Interviews with the 13 DOT managers further revealed that 6

of them would like to use consolidated mitigation for their projects. The remaining seven managers believed that consolidation was unnecessary because of the scarcity of projects, the impracticality of restricting mitigation to designated watersheds (which are often too small), or the negligible number of projects within the respective watershed.

CHAPTER 4

DISCUSSION

Phase I research demonstrated that inconsistencies in the type of data available from the DOTs made it difficult to determine which mitigation options (project-specific or consolidated mitigation) were successful or comparatively more successful. This problem has been consistent since the 1980s (Race 1985, Harvey and Josselyn 1986) and has been further confirmed by the NRC's Committee on Mitigating Wetland Losses report (2001), which found that wetland mitigation data provided by the USACE were inadequate in determining the overall success of any type of compensatory mitigation. Research also illustrated that most DOTs were unable to accurately assess the success of their mitigation programs with respect to compliance and wetland functioning because of inconsistent or nonexistent monitoring requirements or because of the scarcity of databases identifying their mitigation sites. *NCHRP Legal Research Digest 42* (NCHRP 1999) concluded that there did not appear to be a structured tracking system to monitor compliance for transportation projects. In addition, most states simply do not use consolidated mitigation options and, thus, do not have the experience to compare the various options. Therefore, data that definitively indicate which mitigation option has a better permit compliance success rate, or which one provides better wetland functions and values, do not exist.

What does exist is the perception that consolidated mitigation not only offers higher functional replacement values, but also is a more efficient tool with more reliable outcomes. This perception is based on the idea that consolidating projects into one or more larger mitigation project(s) will improve site selection, wetland design, and management. Additionally, the increased oversight by resource agencies, usually coordinated by an MBRT, increases the likelihood that the mitigation wetlands are ecologically sound. For example, Allen and Feddema (1996) reviewed Section 404 permits issued for 75 projects in southern California and found that large-scale projects (i.e., projects with more than 3.5 acres) were typically more successful than smaller projects were. Allen and Feddema recommended that small mitigation projects be either combined into mitigation banks or combined into a larger and more general mitigation/restoration plan for an entire watershed or riverine system. The USACE also encourages the use of consolidated mitigation approaches, such as mitigation banking for nationwide permits, because such mitigation is believed to be more ecologically sound for small-impact projects and eas-

ier for the USACE to enforce (Studt 1998). The USACE recognizes, at least at the highest level, that alternatives to project-specific mitigation may be appropriate in these instances.

The Phase I agency survey results indicated that many DOT wetland managers believed that consolidated mitigation projects were more likely than project-specific mitigation projects to be built on better sites, offered greater design flexibility, and presented the opportunity to incorporate preservation and enhancement with wetland restoration. For instance, 66% (23 of 35) of states responding to the Phase I agency survey question, "Which mitigation option provides the greatest benefits?" (Table 1) indicated that consolidated options were better than project-specific mitigation. Only three states indicated that project-specific mitigation was better. These opinions could be attributed to the fact that banks require financial commitments in advance of wetland impacts and have a more rigorous approval process, motivating DOTs to use mitigation types that have a greater chance for success. Typically, wetland banks must also demonstrate a certain level of ecological performance prior to the disbursement of credits (some states are permitted to disburse credits prior to the completion of construction phases). Therefore, banks may ultimately provide a greater assurance that wetland impacts are truly being mitigated.

The impetus to consider the use of consolidated mitigation options also comes from studies that have found project-specific mitigation to have varying degrees of success. The recent NRC report, *Compensating for Wetland Losses Under the Clean Water Act* (NRC 2001), reviewed wetland research over the last 20 years and concluded that the goal of no net loss of wetlands was not necessarily being met for wetland functions by the nation's mitigation programs. Part of the problem was that many of the mitigation projects had simply not been built, while others had design or construction problems and did not satisfy conditions as stated in the permits. In other cases, the available data were not adequate to determine the status of wetland mitigation sites. Kusler and Kentula (1990), Mitsch and Gosselink (1993), McKinstry and Anderson (1993), and, more recently, Johnson et al. (2000) and the USFWS (1998) highlighted the common problems with many wetland mitigation projects, several of which were also noted in the Phase I agency survey. For example, many of the project-specific sites failed because of poor hydrology, improper grading, inadequate technical capabilities of the wetland construction

crews, and poor coordination between the wetland designers and the construction crews.

OBSTACLES TO THE USE OF CONSOLIDATED MITIGATION OPTIONS

The Phase I results revealed not only that many project-specific mitigation projects were failing to comply with permit conditions, but also that many sites either were not built or did not have sufficient monitoring data to determine success. Additionally, many state DOTs simply lack the opportunity to use consolidated options despite an overwhelming belief that those options, particularly banking, would produce more functional replacement wetlands. As previously stated, only 26 state DOTs have used wetland banking, some very sparingly, for their compensatory mitigation needs. Even fewer states have the opportunity to use an in-lieu fee program.

According to the Phase I agency survey results, the lack of mitigation options used by many state DOTs was most often attributed to the lack of agency coordination, the restriction of mitigation to specific watersheds or subwatersheds, or simply the lack of need. The latter reasons may be attributed to physiographic features, such as the number and size of watersheds, or the number of transportation projects in each watershed. In these cases, consolidated mitigation may simply not be a viable option if wetland impacts are minimal in a given watershed or if appropriate mitigation is unavailable off-site.

The lack of agency coordination, however, was the reason most often stated for the state DOT's inability to develop consolidated mitigation options. Conflicts arising from institutional mistrust and varying regulatory or land management philosophies often present obstacles in the development of a mitigation bank (Redmond et al. 1996). These obstacles are best illustrated by the difficulty states have had in finalizing banking agreements. For example, banking MOAs in Florida, Illinois, Nebraska, Pennsylvania, Washington, and Wisconsin all took two or more years to develop. The issuance of the federal banking guidance in 1995 has not expedited the process. Some early banking agreements have gone through subsequent revisions (e.g., Wisconsin in 1997 and 2001), while others have yet to be finalized. Pennsylvania's state-wide banking MOA and Washington's state administrative rules on mitigation banking (which will supersede the Washington State Department of Transportation's [WSDOT's] current banking agreement) were drafted in 1998, but have not yet been formally approved, even after almost 4 years. Although the Washington draft will likely be finalized in 2002, the inability to reach a consensus over long-term management of banks has stalled discussion in Pennsylvania.

Another reason the DOTs have not been able to develop multiple mitigation options is directly related to the DOTs themselves, whose primary role is the construction and maintenance of roadways. Wetland mitigation is simply one of many issues the DOTs must tackle in order to receive clearance for a project. Compounding this problem is that trans-

portation funds are typically earmarked for particular projects, making DOT project sponsors wary of agreeing to any costs that are not essential for the completion of the project (Krulitz 1979). It is difficult for DOTs to commit to mitigation options that may not address their immediate needs or that require funding commitments beyond the scope of the roadwork. DOTs may hesitate to engage in advanced wetland compensation such as wetland banking because these options require long-term commitments (NCHRP 1992).

SOLUTIONS FOR DEVELOPING CONSOLIDATED MITIGATION OPTIONS

To truly embrace the idea of consolidated mitigation options like wetland banking, DOTs need to fully develop three important capabilities:

- **The ability to develop an estimate of future impacts.** Forecasting wetland mitigation needs involves an understanding of the location of future transportation projects, as well as a determination of the extent of wetland impacts. Typically, this analysis can be completed using a Geographic Information System (GIS) to overlay U.S. Geologic Survey (USGS) and National Wetland Inventory maps with information on future projects from the state transportation improvement plans. If necessary, field surveys can be performed to fine-tune estimates of impacted wetland acres and classes. This approach facilitates the development of a wetland banking program that integrates mitigation needs of individual transportation projects with watershed management objectives. It also ensures that a market truly exists for each bank within a respective watershed. For example, the Maine Department of Transportation (MDOT) currently uses 2-year and 6-year, project-specific planning schedules to facilitate the development of its 20-year transportation plan. These planning schedules enable DOT managers to analyze their mitigation needs prior to roadway construction.
- **A funding schedule that includes monies for mitigation site selection and construction, as well as subsequent wetland monitoring and remediation tasks after the roadway project has been completed.** Consolidated mitigation options like banking require funding in advance of roadway construction. Transportation funds are, however, typically earmarked for specific projects. Therefore, a flexible funding schedule must be developed to provide funds for all phases of wetland mitigation. For example, WSDOT developed the Advanced Environmental Mitigation Revolving Account to provide reimbursable funds for mitigation in advance of project impacts. This account ensures that funds are available for the design, construction, monitoring, and maintenance of wetlands independent of the roadway construction funding schedules.

- **The ability to manage wetland sites in perpetuity or to transfer this responsibility to another entity.** Federal guidance requires that a bank sponsor be responsible for the management of mitigation sites during the lifetime of bank operation and thereafter (Federal Register 1995). In California, for example, a bank sponsor must produce sufficient financial guarantees to ensure the site's maintenance in perpetuity (California Fish and Game Code 1995). However, when transportation agencies are unable to own or manage land, procedures must be implemented to enable the transfer of mitigation sites to another entity. In many cases, DOTs will arrange for a land conservation group, such as the Nature Conservancy, to adopt the management responsibility of DOT banks for the long term. In other cases, DOTs may place conservation easements on these sites or transfer mitigation properties to an appropriate natural resource agency (e.g., state fish and game agency).

The three capabilities are important because they enable the DOTs to estimate whether consolidated mitigation is a timely and cost-effective option. An effective banking program can be developed only with a firm understanding of future wetland impacts, both in acres and class, because the USACE still maintains the right to decide when a bank can be debited. If the wetland bank does not reflect the types of wetland impacts, it is not likely to be considered an appropriate mitigation option.

Wetland mitigation responsibilities do not end after the site is constructed. Resource agencies usually require that the sites be monitored after construction for 3–5 years (NRC 2001). If the site fails, remediation will require unbudgeted money and time. Therefore, it is important that funding be budgeted in anticipation of monitoring requirements. This

budgeting has been a problem in California, where the California Department of Transportation's (Caltrans's) funding schedule does not allocate monies specifically for wetland monitoring (McEwan 2001). Staff biologists have found it difficult to locate funding for wetland monitoring after the roadway work is completed.

Long-term management responsibilities are rarely required for project-specific mitigation (Reppert 1992, NRC 2001). (It should be noted that the USACE issued a regulatory guidance letter in October 2001 in response to the NRC study (see www.usace.army.mil/inet/functions/cw/hot_topics/rgl01_1.pdf). This letter stated that "monitoring will be required for an adequate period of time, normally 5–10 years, to ensure success [of compensatory mitigation projects under the Section 404]" and that the wetland should be permanently protected with appropriate real estate instruments.) In contrast, the 1995 federal banking guidance states that a "bank must be protected in perpetuity with appropriate real estate arrangements which restrict harmful activities which might jeopardize the purpose of the bank" (Federal Register 1995). The inconsistencies between the long-term management responsibilities for project-specific mitigation and the long-term management responsibilities for consolidated mitigation pose a problem for the DOTs, which are generally not equipped to manage land. Again, funds must be set aside to either manage the mitigation banks or otherwise transfer the responsibility to appropriate land conservation entities. Where wetlands are concerned, the FHWA allows the transfer to an "appropriate public agency"; in the case of six states, the FHWA allows the transfer of land to state resource agencies (NCHRP 1992). For example, New Hampshire and California can transfer park lands to an appropriate state or local agency. This transfer is something that Caltrans has been trying to do more often with its wetland sites in southern California (Lewis 2001).

CHAPTER 5

PHASE II RESULTS

The previous section revealed some of the obstacles to using consolidated mitigation options and the three important issues transportation agencies must address in order to develop these options. Resolutions to these issues involve both internal (DOT) and external (resource agency) consensus building. Figure 10 uses a flowchart of a basic banking process to illustrate the key steps to assessing the need for mitigation options and implementing a comprehensive wetland mitigation program. These steps emphasize the need for an internal consensus on banking and the external obstacles to implementing such a program.

The process shown in Figure 10 could apply to any type of mitigation option. The focus is not so much on wetland banking as on addressing the three main issues in Chapter 4, which enable state DOTs to select the best mitigation option for a specific project and circumstance. Only a mitigation program that offers a myriad of options allows the flexibility from which to select the most appropriate site.

STEP 1: DETERMINE PRELIMINARY DEMAND

The process begins internally with a determination of preliminary demand. DOTs need to estimate the amount and geographic distribution of their future wetland impacts to determine whether banking or fee-based mitigation is a viable option. Employing a GIS-based system to overlay proposed project locations with National Wetland Inventory and USGS or land-use mapping would help generate a preliminary analysis of potential wetland impacts. Field surveys would further refine the assessment of preliminary demand. These studies will ultimately reveal whether a statewide banking program or simply a bank in a specific watershed will fulfill the mitigation needs or if third-party mitigation options are available in respective watersheds. For example, the Arkansas Highway and Transportation Department Planning Division, which participates in a GIS users group to share GIS data and discuss projects that may affect other resource agencies, uses its capabilities to determine the extent of environmental mitigation. Another example is the Colorado Department of Transportation (CDOT), which has started a corridor streamlining evaluation project to develop a method for evaluating potential impacts to resources from future projects at the corridor level and during project planning stages. This project builds on

previous CDOT efforts to map wetlands with infrared photography, mapped plant communities, sensitive species habitats, wildlife corridors, historical and archaeological resources, and hazardous waste sites (FHWA 2001c).

STEP 2: DEVELOP INTERNAL COORDINATION AND CONSENSUS

If a demand exists, the next step involves the development of internal coordination and a consensus. This process involves internal preparation to address such tasks as funding and planning for advanced mitigation construction, management of acquired land, and coordination with resource agencies. One of the biggest obstacles to establishing wetland mitigation projects is protecting and managing environmental resources at a mitigation or banking site throughout and after the initial period of establishment (FHWA 1995b). WSDOT developed the Advanced Environmental Mitigation Revolving Account (AEMRA) in 1997 to provide a mechanism to fund environmental mitigation in advance of construction project impacts. When the mitigation sites are used, funds are reimbursed to the AEMRA from the project budget (FHWA 2001c).

After a funding program is integrated into the mitigation process, a consensus among the DOT staff must be developed regarding the management of consolidated sites. The federal guidance on mitigation banking requires that a bank be protected in perpetuity with appropriate real estate arrangements. As discussed earlier, each state transportation agency must determine its ability to manage banks for the long term. In many cases, transferring long-term responsibilities to another resource agency or land conservation entity may be the best option.

Finally, an advanced mitigation program is only effective when sites are completed in time to provide credits for future impacts. There must be internal coordination to develop a program that effectively implements mitigation on schedule. For example, the NCDOT developed a “Full Delivery” program in part to address this issue. The Full Delivery program uses consultants to arrange all phases of wetland mitigation (i.e., site selection, design, construction and management, and agency approval) for projected impacts in specific watersheds. The program was initially implemented to improve cost accounting and to increase the efficiency in the wetland

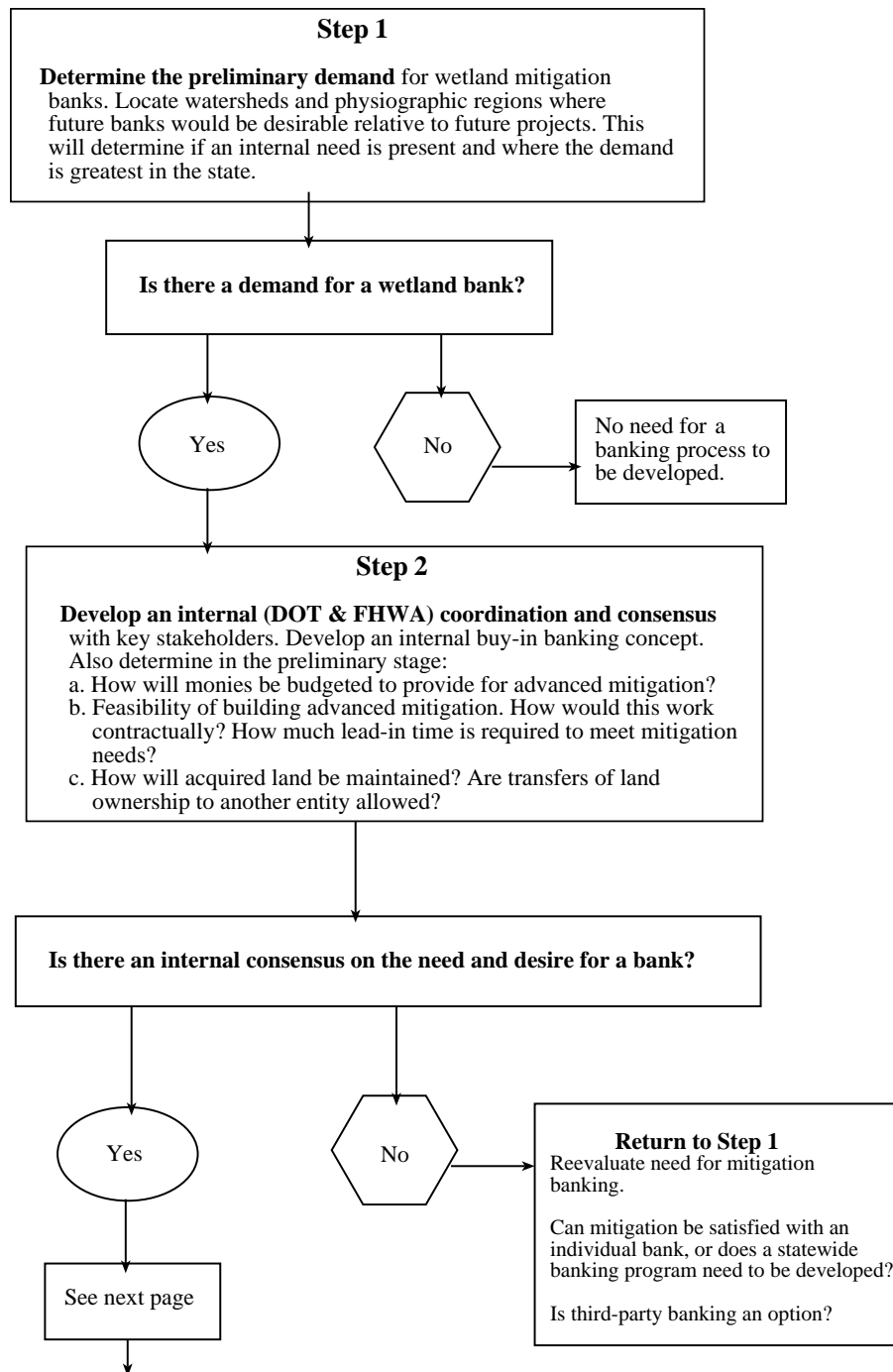


Figure 10. Wetland banking development process for state DOTs.

mitigation process. Initial results suggest that the program will reduce the time needed to develop advanced mitigation sites by half (Robinson 2000).

If an internal consensus cannot be reached on funding and land management strategies, it is necessary to reevaluate the need for advanced mitigation options. Using third-party mitigation may be a more cost-effective and manageable option. In some cases, DOTs have created project-specific mitigation

sites larger than what was required and were permitted to use the additional mitigation toward future projects. It might also be more effective to focus on building one site to better understand the risks involved before committing to a statewide banking program. This focus was the case for the Pennsylvania Department of Transportation (PENNDOT), which created four advanced compensation sites in an effort to promote banking statewide.

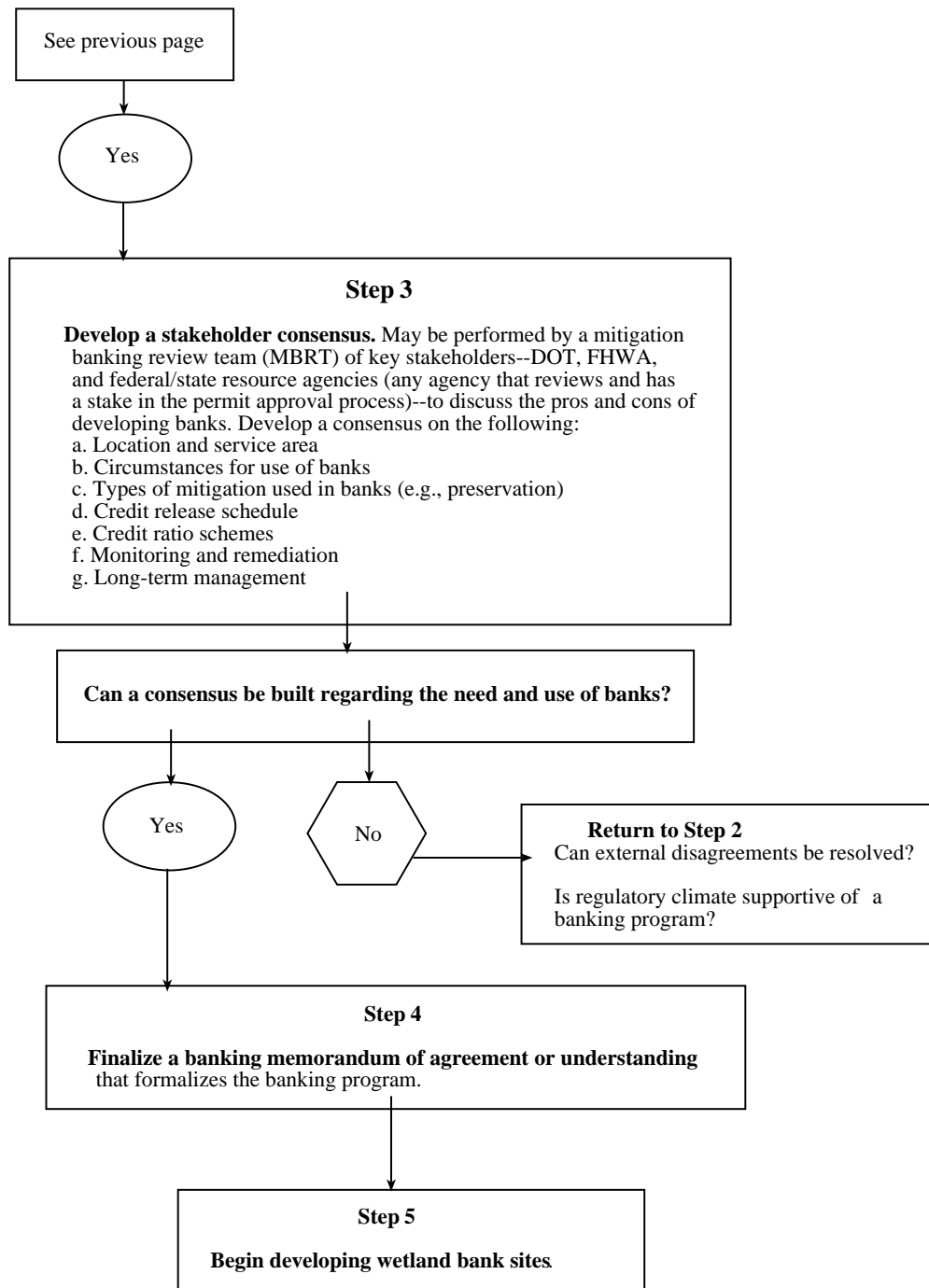


Figure 10. (Continued)

STEP 3: DEVELOP A STAKEHOLDER CONSENSUS

After an internal consensus is reached, the DOTs must develop an agreement on the fundamental banking issues with key stakeholders. The fundamental issues include bank location, service area, credit ratio, release schedules, and monitoring and maintenance responsibilities (these issues

are discussed in depth in Chapter 6). It is important that each of these issues be resolved in a manner consistent with watershed management goals while still making wetland banking feasible. For example, wetland preservation credit ratios can be lowered to promote preservation of high-quality wetlands while providing an economical incentive for bank sponsors to incorporate preservation with other types of wetland mitigation (i.e., 4:1 bank-to-wetland-loss ratio instead of 10:1).

Stakeholders might also be receptive to a credit release schedule that allows for credits to be sold when construction phases are complete. Phasing credit releases enables bank sponsors to raise money for succeeding phases while gauging the demand for wetland credits. In either case, an external consensus on the establishment and use of banks in the state must coincide with internal motives for using wetland banks.

If disagreements on these issues persist, it will be necessary to return to Step 2 and reevaluate if a banking program is still a cost- and time-effective option in the current regulatory climate. If a banking agreement is pursued, it is also important to determine whether there will be a consistent method to delineate service areas, calculate credits, or schedule credit releases. Without consistency, the banking process becomes unreliable, and delays occur as stakeholders must redefine each banking issue during the drafting of the individual banking instrument. This problem persists in California because the statewide banking policy is very general and delegates many decisions to local entities. As a result, Caltrans has been reluctant to pursue banking more actively, never certain about how much time will be required to approve bank proposals.

STEPS 4 AND 5: FINALIZE BANKING AGREEMENTS AND WETLAND BANK PLANNING

The last two steps in the wetland banking development process include finalizing a banking agreement, which describes how each banking issue has been defined, and developing bank plans. Typically, a banking agreement is finalized through an MBRT and outlines the consensus built in Step 3 regarding the establishment, use, and management of banks within the state.

The development of a banking plan may involve several steps. First, a prospectus is issued to the MBRT to initiate the

banking process. This document describes how the bank will be established and operated. Following a comment period (typically 30 days), the banker will be notified of the MBRT's recommendations. After the recommended changes are made, the bank concept is approved, and the banker submits a mitigation banking instrument (MBI), which is the documentation of agency concurrence on the objectives and administration of the bank (Federal Register 1995). After the MBI has been circulated between the MBRT and the appropriate resource agencies, public notice is issued. The MBI is then finalized following predetermined comment periods, and a permit is issued to commence bank construction.

The wetland banking development process in Figure 10 is a generalized outline of the steps necessary to develop a bank. The outline emphasizes that banking programs germinate from an initial determination of wetland mitigation demand and an internal consensus. Banking programs will be ineffective without understanding the need or market for compensatory mitigation and without establishing funding and maintenance programs. The *Wetland Mitigation Banking Guidebook for Oregon* (USACE 2000) cautions that "wetland mitigation banks are likely to be most effective when they address the particular wetland losses anticipated to occur in the watershed." More specifically, the effectiveness of a banking program is quantified by both its ability to produce functioning wetlands for the long term and its ability to convince regulatory agencies that established banks are an appropriate option for compensatory mitigation for unavoidable wetland impacts.

The following chapters discuss banking agreements and state wetland mitigation programs. Chapter 6 compares 10 statewide and DOT banking agreements with the federal mitigation banking guidelines on the establishment, use, and management of wetland banks. Chapter 7 includes case studies of 8 state DOT wetland mitigation programs to highlight how they use the mitigation options available to fulfill their compensatory mitigation requirements.

CHAPTER 6

WETLAND BANKING AGREEMENTS

OVERVIEW

There is a wide variety of reasons why state DOTs do not use the full array of mitigation options. Geophysical factors, the size of watersheds, and the types of wetland impacts all influence the type of mitigation options available to each DOT. The Phase I agency survey results indicated that state DOTs attributed their inability to use consolidated mitigation options to three key reasons: interagency disagreement or lack of a consensus, the impracticality of banking based on current service area requirements, and the difficulty of justifying need due to the number and size of wetland impacts. During the Phase I and Phase II followup interviews with the DOTs and regulatory agencies, additional reasons were given: (1) the inability to forecast mitigation needs, (2) the reluctance to delay projects, (3) the lack of expertise of staff biologists to determine wetland impacts, (4) uncertainty on the time and cost required to pursue banking, and (5) the lack of banking or in-lieu fee agreements or guidance.

The first three reasons above all relate to a DOT's ability to estimate the number and type of wetland impacts and to forecast compensatory wetland needs, which are identified as critical steps in the banking development process in Chapter 5. Only recently have DOTs begun to track their wetland mitigation projects in databases and to use programs, such as GIS, to estimate future impacts. For example, NCDOT developed a database 4 years ago to track the progress of roadway projects and included cost information to ensure that adequate funding was designated for wetland mitigation (Schiller 2001). Furthermore, NCDOT recently hired computer consultants to integrate the various NCDOT databases and improve data management. NCDOT is now using the database to organize its Full Delivery program and forecast mitigation needs in each watershed. Similarly, Caltrans developed a database that uses GIS software (ArcView) to track wetland mitigation projects and link them with information regarding site location, permit requirements, and monitoring reports (Lewis 2001, McEwan 2001). Finally, WSDOT has been using the Environmental GIS Workbench to provide access to more than 60 layers of environmental information data. These data layers are accessed to determine the extent of environmental impacts and issues affecting project planning (FHWA 2001b).

Uncertainty over the time and financial commitment required to develop a banking program is one reason DOTs

have been reluctant to pursue consolidated mitigation options. Unfortunately, no studies adequately estimate the amount of time and money required to develop various mitigation options. NCHRP research focused on the efforts to develop several statewide banking agreements for some guidance. For instance, a review of 10 banking agreements suggested that it generally takes 2–3 years to approve an agreement. However, since the issuance of the 1995 federal banking guidelines, several early agreements have been revised, and Pennsylvania's statewide banking agreement and Washington's state administrative rules on mitigation banking have not been finalized even after 4 years.

Estimating the cost of developing a banking program is equally difficult. For instance, the costs will vary depending on the time spent developing banking agreements and instruments, as well as the time required to find appropriate sites for each bank. Costs will also vary depending on the mitigation type incorporated in the banks (preservation is much less expensive than restoration or creation), as well as on whether the land is acquired for bank development. At this time, there is no consistent way to calculate the cost of developing a banking program.

Finally, many DOT wetland managers acknowledged during followup interviews that they were unfamiliar with the language used in banking agreements. For example, the managers wanted to know how service areas were defined or how credit release schedules were organized in other states. A matrix outlining many of the key issues relevant to banking agreements is featured in Table 2.

BANKING AGREEMENT ISSUES

The prominent issues relevant to banking agreements include service area, credit release schedules, credit ratios, monitoring requirements, long-term management responsibilities (when banks are appropriate for use), and the use of wetland preservation and wetland buffers for mitigation credit. How these issues are defined varies according to the level of detail that resource agencies require prior to the preparation of a banking instrument. The 1995 federal banking guidance was issued to "clarify the manner in which mitigation banks may be used to satisfy mitigation requirements of the Clean Water Act Section 404 permit program and the wetland conservation provisions of the Food Security Act" (Federal Reg-

ister 1995). Using this guidance, each banking agreement reflects the specific information that the regulatory agencies expect prior to the development of individual banking instruments. For example, California's state policy on conservation banking provides some guidance on wetland banking; however, the specific decisions regarding each issue (i.e., service area) are made at the individual bank level with local assistance. In contrast, some banking agreements provide specific guidance on the issues (e.g., service areas).

The federal banking guidelines were issued to clarify when banks are an appropriate form of wetland mitigation and how they will be established and operated. The guidelines were meant to be not law, but guidelines on the interpretation of existing policy (NRC 2001). The following summary illustrates how some states have modified the federal guidance to suit their specific natural resource management needs. For instance, California and Minnesota have incorporated controls on banking that require local governmental approval of bank site selection. Illinois's banking agreement states that the "preferred method of bank credit generation is restoration or creation . . . and [should] be a minimum size of 25 acres" to encourage the development of large, new wetland tracts (USACE 1997). Wisconsin's agreement places a priority on developing low-maintenance sites and emphasizes the restoration of drained wetlands in the state's glaciated regions. In each case, the states have tailored a banking program to suit their respective watershed or natural resource management plan. The benefits of wetland banking can be realized only when all stakeholders can come to a consensus on the establishment and management of these banks to ensure that a market exists for the derived credits and that the banks provide appropriate mitigation for lost wetland functions.

The following sections outline 8 of the issues defined in 10 state banking agreements and compare them with the federal banking guidance.

Service Area

The service area is the area that the wetland bank can use to provide compensation for wetland impacts and can influence the location of a bank by restricting credit use to a particular watershed or other area of interest (Goode 1998). The federal guidance states that the service area is "where a bank can reasonably be expected to provide appropriate compensation for impacts to wetland and aquatic resources" (Federal Register 1995). Impacts outside of the service area can be accepted in some situations. Many banking agreements delineate service areas by watershed or drainage boundaries, reserving the MBRT's right to impose larger or smaller service area boundaries. For example, the Pennsylvania and Illinois banking agreements base the service area on watershed or subwatershed boundaries. Service areas are also based on the function and values of impacted wetlands. Both Min-

nesota and Florida define service areas as the area that resembles "lost function and public values" and can adequately offset impacts according to the local ecological or hydrological conditions.

Credit Release Schedules

Credit release schedules specify when credits can be withdrawn. Mitigation banking is often referred to as advanced mitigation. However, it has become a more common practice to allow for the selling of mitigation credits prior to the completion of the bank. The early release of credits may be dictated by the completion of individual phases, such as grading, planting, and monitoring. Phasing credit releases is one method for bank sponsors to raise funds for construction phases while limiting the financial risk to investors. For example, Florida allows 15% of the bank's credit to be sold prior to construction as a way to raise money for construction or planting activities (Florida Statute 1993). Maryland and Washington allow for the release of 50% of credits after construction, but prior to the satisfaction of performance standards at the conclusion of the monitoring period (Gardner 1996, Washington Department of Ecology 2000). Illinois's banking agreement actually distinguishes private and public bank sponsors, allowing up to a 30% preconstruction release for private bankers, while public bank sponsors must complete bank construction and demonstrate appropriate wetland hydrology before releasing credits.

The federal banking guidance does not prohibit these early credit releases. As long as a banking instrument is approved, a site is secured, and appropriate financial assurances are established, the MBRT can allow bank sponsors to release credits in advance of the successful completion of the bank. Of the 10 banking agreements described in Table 2, only Nebraska and Pennsylvania's PENNDOT Interagency Wetland Agreement prohibit credit releases prior to meeting performance standards. Pennsylvania's Statewide Wetland Banking MOA, however, will allow 10% of anticipated credits to be released when as-built plans are approved.

Credit Ratios

Credit ratios are a mechanism for converting wetland impacts into a mitigation value. This mechanism is usually based on the number of wetland acres impacted and the type of mitigation provided (e.g., 2 acres of mitigation for 1 acre of impact). For example, 1 acre of in-kind mitigation might be required for 1 acre of wetland impact. However, the ratio may be greater if the mitigation is of a different kind or if wetland preservation or enhancement is the mitigation type provided. The credit ratio may also be related to wetland function. In these cases, a functional assessment methodology, such as a habitat evaluation procedure (HEP) or a hydrogeomorphological assessment, is performed to quantify the

TABLE 2 State wetland banking rules and agreements

	Federal Guidance on Mitigation Banking (1995)	Florida State Banking Rules, Chapter 62-342	Illinois, Interagency Coordination Agreement on Mitigation Banking (1997)	Minnesota Conservation Act Rules on Wetland Banking, Chapter 8420 (Mar-1998)	Nebraska's Banking MOA
<u>Service Area</u>	Used in conjunction with a watershed management plan and to address specific resource needs of a particular watershed. The service area should be guided by the USGS Hydrologic Unit map and the US ecoregions as described by Omerik (1986) or Bailey (1980), as well as state and regional classification systems. The service area is where a bank can reasonably be expected to provide appropriate compensation for impacts to wetland and/or aquatic resources. Mitigation for impacts outside of the service area is acceptable when determined practicable and environmentally desirable.	The service area may be larger than the regional watershed if adverse impacts to wetland outside the watershed could be adequately offset by the bank. However, the service area could be smaller. This will be determined by the MBRT.	Within same watershed. Higher credit ratios if mitigated outside of the watershed at the discretion of the MBRT.	For impacts in a location that resembles lost function and public values at the impact site or in a location that maximized important wetland functions and public values. Restored wetlands are accepted in bank. Created wetlands are accepted only in counties where 80% or more of pre-settlement wetlands are intact. In other counties, creation is accepted only if wetlands are created by excavation of non-wetlands by dams or dikes.	The service area is designated as the area (watershed, county) wherein a bank can reasonably be expected to provide appropriate compensation for impacts to wetlands and/or other aquatic resources.
<u>Credit Release Schedule</u>	Release of credit only when (1) a banking instrument and mitigation plan have been approved, (2) a bank site is secured, and (3) appropriate financial assurances have been established. Initial physical and biological improvements should be completed no later than the first full growing season following initial debiting.	The number and schedule of credit releases will be determined based on the performance criteria of the mitigation bank and the success criteria for the mitigation activity. MBRT and WMD make this determination. Generally, 15% pre-construction, 25% post-construction, 50% after performance standards met. 10% of credits retained until construction and initial exotic eradication are completed.	Credits can be sold prior to construction but at a higher mitigation ratio. <u>For Privately sponsored bank:</u> Maximum of 30% pre-construction, 20% upon demonstration wetland hydrology; 20% after hydrology is accepted and planting approved. Final 30% upon full certification. <u>For Public and single-user banks:</u> No pre-construction release, 30% after construction and wetland hydrology, 20% after planting is approved (with appropriate hydrology). Final 50% upon full certification. Incremental release of credits is possible if, for example, 50% of the wetland acres have appropriate hydrology.	Proposed wetland must be constructed within 2 years of approval. After first year of construction, the LGU must make a final determination of the wetland bank acceptability and approve wetland credits.	All banks will always maintain a positive credit balance unless it is specifically set up to allow for advance credits.
<u>Credit Ratios</u>	Credits must be determined by an appropriate functional assessment methodology (HEP, Hydrogeomorphic). The same methodology must be used for debit assessment.	Credit ratios are determined by the increase in ecological value resulting from restoration, enhancement, preservation, or creation activities. For creation, the ratio is 1:1; for the remaining types, ratios will be determined by the extent of ecological improvements attained.	Units of credit are in acres. Full credit (100%) will be given for wetland creation and restoration. Partial credit (50% or less) for preservation and enhancement to be determined by the Corps and other signatory agencies.	no specifics indicated.	In-kind credits are based on acreage, while out-of-kind credits will be based on a functional analysis approach that can be translated into acreage. Higher ratios may be required for any requested advanced credits, out-of-kind credits, or enhancement credits. All banks will always maintain a positive credit balance unless it is specifically set up to allow for advance credits.
<u>Monitoring</u>	Monitoring will typically be for 5 yrs and will require the banker to submit annual monitoring reports to the authorizing agency.	no specifics indicated.	5 years from the date of approved planting plan. Annual reports.	no specifics indicated.	Will be specified in the site plan, however NDOR will monitor the site on an annual basis.
<u>Long-Term Management</u>	The bank must be protected in perpetuity with appropriate real estate arrangements (easements, title transfer) which restrict harmful activities that might jeopardize the purpose of the bank. In no case should finite protection extend for a lesser time than the duration of the project impacts for which the bank is being used to compensate.	no specifics indicated.	Bank sponsors are strongly encouraged to establish agreements for long-term management with public or private conservation organizations.	no specifics indicated.	NDOR will seek to acquire permanent surface easements from current owners or will acquire appropriate properties for bank development and have a resource agency (e.g., NE Game and Parks Commission) or USFWS, or private entity (i.e., Nature Conservancy) take title and manage the banked land as a permanent wetland.

Pennsylvania Statewide Umbrella Wetland Banking Draft MOA (2001)	PENNDOT Interagency Agreement for Advanced Wetland Compensation (1995)	Washington Wetland Mitigation Bank Rule, Chapter 173-700 (Aug-2000)	Washington Department of Transportation Wetland Banking MOA (as of 2001)	Wisconsin's Wetland Banking Technical Guides (WisDOT 2001)	Wyoming Statewide Wetland Mitigation Bank (1995)
Based on the Pennsylvania State Water Plan subwatersheds.	Based on the sub-basins in District 9-0.	The MBRT will determine the appropriate service area. Based on landscape position of bank in watershed, ecological functions of the bank and their extent outside the bank, local need and requirements, consistency with land-use and watershed management plans, and the WRIA in which the bank is located. Credit can be used outside of service area if accepted by MBRT.	no specifics indicated.	Movement of debited wetland losses from one watershed to another is permitted. No set service area.	The river basin in which the impact occurred. Large basins are divided into subwatersheds, while small basins are consolidated into larger watersheds in order to equalize the banking service areas.
10% of anticipated credits are released after construction and submission of as-built plans. Remaining credits are released after Performance Standards are met.	no specifics indicated, however, likely that no advanced credit release will occur.	Pre-construction (to be determined by MBRT); post-construction (up to 40%); Attainment of hydrologic performance standards (up to 50%).	50% released post-construction, 50% released when performance standards have been met and a minimum of 5 yrs after as-built conditions are accepted.	no specifics indicated.	no specifics indicated.
no specifics indicated.	Credits are determined by size and type of wetland.	Restoration (1:1 - 1:2); Creation 1:1 - 1:5; Enhancement (1:2 to 1:6), Preservation (1:2 to 1:10 if combined with restoration or creation, 1:5-1:20 if alone).	At least 1:1, however ratios change depending on the type of credits available (post-construction or after performance standards are met). Lower ratios are for mitigation completed in advance, while higher ratios are for post-construction releases.	If replacement at bank site ratio = 1:1, assumed no risk; if compensation is done concurrent with project ratio = 1.5:1. If wetland debit is taken to bank site the ratio floor is 1:1 and increments are added to it based on Table 3C (Appendix C: Wisconsin MOA). Maximum ratio in this system is 3:1.	Expressed in acre-units. New acres of wetland are equal to the credit amount (10 acres = 10 credits). Enhancement is at the maximum 50% of acre enhanced. Exact value depends on the extent of the increase in functional value attained. Only 25% of total wetland loss can be mitigated by enhancement.
A minimum of 5 years. Yearly monitoring reports are required.	Sites will be monitored for 5 years after construction. Thereafter, monitored bi-annually until credited out.	At least 5 yrs.	Semi-annually for 5 yr period. After performance standards are met, monitoring is for 30 yrs at 10 yr intervals.	Based on the determined level of monitoring (Basic, Standard, Expanded Standard). Generally, monitoring is for 5 yrs for Standard monitoring level.	no specifics indicated.
The Sponsor will maintain the site until bank closure according to the Development Plan. Following closure, the Sponsor will maintain the bank as directed by the Permitting Agencies. Routine maintenance and monitoring will not be required after closure. Upon bank closure, the Sponsor can transfer the legal interest in the site to any public or private entity as long as it will continue to be protected in perpetuity.	PENNDOT will place property restrictions or easements, acceptable to USACE and DEP to guarantee protection in perpetuity.	Long-term manager be specified in the MBI and must be permanently protected and preserved in their natural state.	DOT will permanently retain all bank sites.	Sites are either purchased or leased. Purchased sites are either retained by DOT or donated to DNR, or another public or private entity.	no specifics indicated.

(Table continues on next page)

TABLE 2 (Continued)

	Federal Guidance on Mitigation Banking (1995)	Florida State Banking Rules, Chapter 62-342	Illinois, Interagency Coordination Agreement on Mitigation Banking (1997)	Minnesota Conservation Act Rules on Wetland Banking, Chapter 8420 (Mar-1998)	Nebraska's Banking MOA
When Can Bank Be Used?	When there is no practicable opportunity of on-site compensation or when use of a bank is environmentally preferable to on-site compensation.	When on-site mitigation opportunities are not expected to have comparable long-term viability due to such factors as unsuitable hydrologic condition or ecologically incompatible existing adjacent land uses or future land uses identified in a local comprehensive plan. Or when uses of the bank would provide greater improvement in ecological value than on-site mitigation.	It is intended to be used for impacts associated with projects which affect relatively small acreage of low value wetlands or other waters of the U.S.	no specifics indicated.	no specifics indicated.
Use of Preservation Mitigation	Credit can be given for Preservation when it is in conjunction with Restoration, Creation, and Enhancement and when it is demonstrated that Preservation will augment the functions of the resources. Alone, Preservation can only be used in exceptional cases.	no specifics indicated.	Preservation is expectable only under acceptable circumstances (preservation of extremely high functional value). Cannot be more than 30% of the total potential credit or consist of more than 15% of total bank acreage.	Not accepted.	Only in exceptional circumstances (same as Federal Guidelines).
Buffers	Mentioned as "upland area." Credit can be given for upland areas only if it increases the overall ecological function of the bank and receives the same protected status as the rest of the bank. These areas can derive credit for their functional attributes.	not mentioned - usually taken as preservation credit.	Banks should contain upland buffers to protect the wetlands from potentially incompatible land uses on adjacent parcels. Partial credit (25%) is given for buffers if it can be demonstrated that they provide tangible benefits (e.g. Nutrient and sediment filtering). If uplands have no clear beneficial or intended benefits, no credit is awarded.	no specifics indicated.	A buffer requirement will be incorporated in the bank plan whenever necessary to restrict sediment delivery to the mitigation site. Typically, the buffer will be 50 ft wide. The credit ratio for buffers will be 0.25 credit for every acre successfully developed.
Misc.	Restoration should be the first option when locating a bank site.	no specifics indicated.	Preferred method of generation bank credit will be restoration or creation of new wetlands as this will result in a net gain of wetland acreage. Banks will be generally held to a higher standard of performance than conventional mitigation sites. Banks should be a minimum size of 25 acres.	For wetland to be accepted by bank, local government unit must approve of it. Minimum of 0.1 acres to be eligible for a deposit into bank. Deposit of 10 acres or smaller wetland is 100%. Over 10 acres, only 90% credit is accepted. This provides incentives to depositing small wetlands.	Goal is to establish wetland banks in each physiographic region of the state with 150% of the NDOR 6 yr projected mitigation need.

DEP = department of environmental protection.
DNR = department of natural resources.
LGU = local government unit.
MBRT = mitigation banking review team.
MOA = memorandum of agreement.
NDOR = Nebraska Department of Roads.
USACE = U.S. Army Corps of Engineers.
WMD = water management district.
WRIA = water resource inventory area.

effects of the projects on fish and wildlife habitat, as well as on such wetland functions as nutrient filtration or storage capacity. In either case, a functional assessment is performed to (1) determine exactly what functions or values the bank provides and (2) translate those functions and values into bank credits using a credit ratio method. The credits are then used as the bank's currency.

The federal banking guidance provides flexibility in the determination of credit ratios, simply stating that the credits must be determined by an appropriate functional assessment methodology. Many states chose to loosely define their credit ratio schemes. Florida calculates its credits according to an increase in ecological value resulting from the different mitigation types, while Pennsylvania and Nebraska estimate the amount of required mitigation on the basis of the size and type of impacted wetlands or whether the mitigation wetlands are

in-kind or out-of-kind. Washington and Wisconsin banking agreements are more specific, offering conversion ratios. Washington state's bank rules list ratios for restoration as 1:1 to 1:2, creation as 1:1 to 1:5, enhancement as 1:2 to 1:6, and preservation as 1:2 to 1:20. The Wisconsin banking agreement calculates the credit ratios according to the "uncertainty of completely establishing the hydrologic regime for project-specific wetland restoration or creation." For example, a 1:1 ratio is assigned to projects when the bank site has an established wetland (i.e., risk is eliminated), and a 1.5:1 compensation ratio is assigned when the wetland compensation ratio is done concurrent with the transportation project. Depending on the drainage area, floristic province, and wetland type, the wetland compensation ratio can be as high as 3:1 (WisDOT 2001).

Regardless of the conversion rate, credit ratio schemes are a way to quantify the wetland value lost and to assign

Pennsylvania Statewide Umbrella Wetland Banking Draft MOA (2001)	PENNDOT Interagency Agreement for Advanced Wetland Compensation (1995)	Washington Wetland Mitigation Bank Rule, Chapter 173-700 (Aug-2000)	Washington Department of Transportation Wetland Banking MOA (as of 2001)	Wisconsin's Wetland Banking Technical Guides (WisDOT 2001)	Wyoming Statewide Wetland Mitigation Bank (1995)
When minimized impacts total 1 acre or less and on-site replacement is not practical or wetland banking provides a greater environmental benefit. If impact is greater than 1 acre, then wetland banking is appropriate when on-site or off-site replacement is not practical or if wetland banking provides greater ecological benefits.	Each year, PENNDOT will submit a list of wetland impacts (for each sub-basin) for approval.	no specifics indicated.	no specifics indicated.	For impacts where compensatory mitigation is not located within 2.5 mile radius of impact.	Man-made wetland which is created or enhanced after July 1, 1991. Credits will only be given for creation, restoration, enhancement or for ecological function, not in response to federal regulatory action, administrative order or court order.
no specifics indicated.	no specifics indicated.	Preservation can be used and is encouraged.	Preservation is accepted only when used in conjunction with restoration, creation or enhancement.	Encouraged for red flag wetlands as well as historically significant wetlands. Ratio is 8:1.	no specifics indicated.
no specifics indicated.	no specifics indicated.	All banks will be required to have sufficient buffers (50-300ft) to assure sustainability, however, the buffers will not generate credit.	no specifics indicated.	Vegetated upland buffers with non-invasive grass, forbs or shrubs can be creditable. Upland buffer must not exceed 15% of site and is credited at a ratio of 4:1 as wetland credit.	no specifics indicated.
Upon activation of the Wetland Banking Program, PENNDOT will no longer be eligible to utilize the Wetland Replacement Fund.	no specifics indicated.	Banks should be integrated into the watershed management plans. The local jurisdiction in which the bank is located shall be the signatory of the banking instrument.	Can only be used after 404 sequencing and after some in-kind, on-site compensation had been provided.	Emphasis is placed on developing low maintenance sites or ones requiring passive management. Wetland restoration of drained wetland is preferred, usually found in states glaciated region (entire state except west, central, and southwest).	Very little interest so far - only one deposit at this time (preservation of irrigated pasture wetlands). Wetland creation, restoration, enhancement is deposited into a statewide bank for future crediting.

appropriate mitigation. In many cases, this mitigation can be provided in a number of fashions, as long as the amount of wetland acres of creation, restoration, enhancement, or preservation is equal to the value of the wetlands impacted.

Monitoring Requirements

Wetland monitoring is required in order to assess the performance of mitigation banks. The federal banking guidance recommends annual reports processed over a 5-year monitoring period. The banking agreements featured here are consistent with this standard. In some cases, the agreements specify that bank sponsors extend monitoring past the 5-year period. PENNDOT's banking agreement states that its sites must be monitored until they have sold all the credits. WSDOT is

required to monitor its sites at 10-year intervals for 30 years after the performance standards are met.

Long-Term Management

Banks may require periodic maintenance, even after performance standards have been met during the 5-year monitoring period. To ensure that these sites are not simply abandoned, federal guidance requires that banks be protected in perpetuity. Many of the banking agreements suggest the transfer of title to an appropriate public, private, or nonprofit organization to fulfill this responsibility. Illinois's Interagency Coordination Agreement on Mitigation Banking encourages bank sponsors to establish agreements with public or private conservation organizations. PENNDOT's agreement specifies

that property restrictions or easements must be placed on PENNDOT's bank properties.

Use of the Mitigation Banks

Mitigation banks can provide numerous benefits, from simple economies of scale achieved by consolidating projects to facilitating compliance monitoring and reducing the uncertainty over whether mitigation will be successful. However, on-site mitigation is still the priority. The federal banking guidance stipulates that banks can only be used when there is no practical opportunity of on-site compensation or when use of a bank is environmentally preferable to on-site compensation. Many of the states have interpreted the definition of "environmentally preferable" to suggest that banks are a more appropriate mitigation option for small impacts. For instance, the Illinois banking agreement recommends using banks to mitigate impacts on "small acreage of low-value wetlands" (USACE 1997), while Pennsylvania's draft statewide banking agreement indicates a preference for banking when impacts total "1 acre or less and on-site is not practical." Wisconsin DOT designates a 2.5-mile radius as a threshold distance for locating on-site mitigation sites. A bank can be recommended when that limit has been exceeded.

Wetland Preservation

Wetland preservation is often discouraged as a wetland mitigation type, except in unusual cases, because it does not compensate for lost wetland acreage. The federal banking

guidelines suggest that preservation can only be used when it is in conjunction with creation, restoration, and enhancement and when it is demonstrated that preservation will augment wetland functions. Many banking agreements follow the federal guidelines, while others provide further assistance. Illinois's agreement stipulates that preservation can never be more than 30% of the total bank credit or 15% of the total bank acreage. In contrast, Washington and Wisconsin encourage the use of preservation as a means to protect historically significant or high-functioning wetlands at substantially higher credit ratios.

Wetland Buffers

Wetland buffers play an important role in the protection of wetland habitats from adjacent land uses. They generally consist of a minimum 50-ft-wide upland area that borders the wetland. Upland buffers moderate influences on wetlands, including the regulation of surface runoff or the migration of invasive species to the site. According to the federal banking guidance, buffers can generate banking credit only if they increase the overall ecological function of the bank and are afforded equal protection. Illinois, Nebraska, and Wisconsin permit only partial credit (25%) for buffers that are determined to play an ecological function. However, if there is no clear beneficial or intended benefit, the buffers do not generate any credit. Washington actually requires buffers to ensure the sustainability of banks, but does not award additional credit for their use. This has been a point of contention between the DOTs because land used as a buffer does not contribute to the generation of mitigation credit.

CHAPTER 7

CASE STUDIES: EIGHT STATE DOT WETLAND MITIGATION PROGRAMS

All wetland mitigation options clearly have their benefits and drawbacks. The regulatory power granted to federal and state regulatory agencies, while specific in its intention, ultimately provides the flexibility for these agencies to interpret according to their discretion. As a result, state DOT wetland mitigation programs reflect this variability. For example, many New England and mid-Atlantic states rely primarily on project-specific mitigation, while southeastern states like Florida, Louisiana, and Georgia, as well as west coast states like California and Washington, have all developed banks that are used by the transportation agencies (Figure 1).

During the course of Phase I and Phase II followup interviews, DOT wetland managers were asked to specify what information they would find most valuable for developing more comprehensive wetland programs. They frequently requested information regarding the mitigation options used by other state DOTs. As this request paralleled the objectives for NCHRP Project 25-16, the research panel agreed that case studies of various state DOT wetland mitigation programs would be an invaluable resource. The panel selected the following states on the basis of geographic distribution across the United States and diversity of the mitigation options used. The following states are discussed below: California, Florida, Louisiana, Maine, North Carolina, Pennsylvania, Washington, and Wisconsin (see Table 3). These case studies reveal how eight state transportation agencies manage their compensatory wetland mitigation needs and whether consolidated mitigation options are integral to the satisfaction of their compensatory wetland requirements.

Each case study is organized into three sections: “Background: Wetland Mitigation History,” “Status of DOT Consolidated Mitigation,” and “Wetland Program Evaluation.” The first section summarizes wetland mitigation statewide, looking at legislation supporting mitigation and research evaluating the success of wetland mitigation. The second section delves into which consolidated mitigation options are used by the state DOT. The final section evaluates the DOT’s wetland program and whether it is effectively fulfilling the DOT’s mitigation needs. Table 3 summarizes the eight case study states.

CALIFORNIA

Mitigation options used by DOT:

- Project-specific, nonadvanced consolidation, third-party, and DOT banking.

State banking legislation:

- Sacramento–San Joaquin Valley Wetlands Mitigation Bank Act 1993, California Fish and Game Code SS 1775-1796.

Background: Wetland Mitigation History

Paralleling wetland mitigation studies in Florida, researchers in the early 1990s found that many mitigation sites in California were not being built or monitored or failed to satisfy their permit requirements. Holland and Kentula (1992) discovered that only 31.5% of the Section 404 permits required monitoring at least once, making a determination of success nearly impossible to gauge. DeWeese (1994) also demonstrated that only 69% of the mitigation in southern California complied with existing permits. These results showed a troubling trend of inadequate or substandard mitigation and supported efforts to find effective alternatives to project-specific mitigation.

On May 13, 1991, an MOA was entered into by Caltrans, the FHWA, the EPA, the USFWS, the USACE, and the California Department of Fish and Game, among others, to explore all appropriate mitigation and enhancement options, to consider the application of excess compensation for future projects, and to permit “banking” when appropriate opportunities existed for the establishment of DOT banks (FHWA 2001d). This MOA, however, has never truly been used for banking guidance (Bean 2001, Alvarez 2001).

In 1993, California’s Governor Wilson’s State Wetlands Conservation Policy encouraged “. . . decisions to locate banks in the context of local and regional plans” (Wilson 1993). That same year, a memorandum of understanding (MOU) was signed by Caltrans, the Federal Transit Administration (FTA), the FHWA, the EPA, the USFWS, the USACE, the California Department of Fish and Game, the Arizona Department of Transportation (ADOT) and the Nevada Department of Transportation (NDOT) to integrate the National Environmental Policy Act of 1969 (NEPA) and Clean Water Act Section 404 and to streamline the environmental permitting process (Caltrans 2000). This MOU likely encouraged greater commitment among the agencies to pursue wetland banking as a viable option for transportation

TABLE 3 Summary of case study states

	CA	FL	LA	ME	NC	PA	WA	WI
Project-Specific Mitigation	X	X	X	X	X	X	X	X
DOT-Sponsored Banking	X	X	-	-	X	X	X	X
Third-Party Banking	X	X	X	-	X	-	X	-
In-Lieu Fee/RMA	-	X	X	-	X	X	-	-
State Legislation Supporting Banking	X	X	X	X	X	Has not been finalized	X	X
Time to Develop Statewide (or DOT-Specific) Banking Agreement	1991 MOA on Banking (timeframe unknown) 1993 MOU on Conservation Banking (timeframe unknown)	No formal banking MOA State Environmental Reorganization Act dictates WMDs to find DOT mitigation	No formal banking MOA	No formal banking MOA	No formal banking MOA An MOU with WRP took approx. 2yrs	2 years for the PENNDOT District 9 MOA 4+ years for the Statewide Banking MOA (still pending)	2 years for DOT MOA (Revised 4yrs later) 4 years for Statewide Banking Rule	2+ yrs for the Mitigation Banking Technical Guidelines (revised in 1997 and 2001)

MOA = memorandum of agreement.
MOU = memorandum of understanding.
RMA = regional mitigation area.
WMD = water management district.
WRP = wetland restoration program.

impacts. However, California's current banking policy resides primarily under the umbrella of the 1995 State Policy on Conservation Banking, which not only addressed wetland impacts, but also addressed impacts to (1) the habitat of endangered or threatened species and (2) mitigation required by the California Environmental Quality Act (CEQA) (Goode 1998). The policy's focus is on providing a strong statewide conservation plan with specific goals, yet it does not go as far as requiring mitigation banks to adhere to conservation plans. As a result, there is a lack of statewide policy clarity with respect to banking standards, and banking decisions are often influenced by local goals.

Status of Caltrans Consolidated Mitigation

California has the second largest number of wetland mitigation banks in the United States, with approximately 27 banks active and 8 banks awaiting approval (ELI 2001). Many of these banks, though, are conservation banks without a wetland component and are not sponsored by Caltrans. The reluctance of Caltrans to establish a greater number of banks is related to several issues. Discussions with the California Department of Fish and Game and the San Francisco division of the USACE indicated that Caltrans had not approached its MBRT for guidance on wetland banking partly because of the large number of mitigation projects, the high turnover rate of Caltrans biologists (leading to an inexperience with

transportation-related projects), and the difficulty in finding funding for monitoring wetland mitigation sites. These reasons all contribute to the difficulty staff members have had developing banking plans and an internal consensus in addition to completing their individual projects.

The lack of a statewide banking guidance and the difficulty of developing the necessary local consensus on site selection has compounded the problem with developing banks for Caltrans. The current state policy on conservation banking provides only general guidance on the operation of banks, delegating the major decisions to local entities. Incorporating local controls into the banking process can have beneficial results; however, without a more detailed banking MOA, bankers have found the drafting of banking instruments to be excessively tedious, while others are simply reluctant to invest in this option at all.

Wetland Program Evaluation

California's economic boom over the last 20 years, especially in the areas surrounding metropolitan Los Angeles and San Francisco, increased the demand for a more extensive transportation system. The corresponding increase in wetland impacts created a suitable environment for the adoption of multiple mitigation options by Caltrans. However, the agency has not pursued consolidated mitigation options in areas outside of the San Diego area partly because of the lack of clear statewide mitigation banking guidelines, the

decentralized nature of Caltrans districts, and the inflexibility of Caltrans funding for mitigation site maintenance.

Caltrans has, however, taken two important steps toward improving partnerships with resource agencies and developing a better decision-making tool for wetland mitigation. In 1999, Caltrans, the FHWA, and the EPA developed a partnership pilot program to develop joint initiatives that will help reduce project delays through the collaboration on strategies to meet transportation and environmental project priorities (FHWA 2001c). This partnership effort was nominated for the Excellence in Environmental Leadership award for developing the initiatives to improve coordination among all resource agencies and Caltrans through management meetings, training and outreach, rotating assignments for individuals in each agency, funding coordination, NEPA/404 integration, guidance development, a metropolitan planning pilot program that developed a model for integrating land use, and transportation and environmental planning.

The second step was to develop a comprehensive database to manage Caltrans's past and present mitigation efforts. This GIS-based database maintains the project history information of Caltrans's wetland projects. Although developing this database has proven to be exceedingly difficult because of the disparity among the quality and quantity of data statewide, the database will ultimately enable Caltrans to understand the success rates of past projects and to improve Caltrans's future compensatory mitigation efforts.

FLORIDA

Mitigation options used by DOT:

- Project-specific, nonadvanced consolidation, third-party and DOT banking, and in-lieu fee (a.k.a. regional mitigation areas).

State banking legislation:

- Ch.373.4135-.4137, ch. 373.414, ch. 403.9332.

Background: Wetland Mitigation History

FDOT's wetland mitigation program reflects a recent objective to develop consolidated mitigation options with a landscape perspective. The ultimate goal is no net loss of wetland function, not just wetland area. Studies by the department of environmental protection (DEP) in 1990 and studies in southern Florida revealed that project-specific mitigation was not working (Erwin 1991). One-third of the required mitigation projects were never implemented, and only 27% of the completed mitigation was deemed ecologically successful (Redmond et al. 1996). In southern Florida, 60% of the project-specific mitigation sites were incomplete or deemed a failure.

In response to the failure of many project-specific mitigation sites, Florida developed a formal banking program from the 1993 Florida Environmental Reorganization Act (Section 373.4135, F.S.). This act coordinated the permit process between the DEP and the five WMDs, whose role is to manage the water-related resources to maintain a balance between water users and the natural systems that provide the existing and future water supply. The act also formally supported the use of regional mitigation areas (in-lieu fee) and mitigation banks to offset wetland impacts and led to the development of the state mitigation banking rules (Section 62-342). These rules also encourage the five WMDs to establish two banks, as well as mitigation areas, in their respective districts, which would supplement their existing funding of land acquisition programs. Initially, the act required the WMDs to develop the two mitigation banks by January 1, 1995, or report why these banks have to be developed. Currently, only the South Florida Water Management District (SFWMD) has developed two banks, both with public-private contracts. These banks are the Loxahatchee Mitigation Bank (1,264 acres) in Palm Beach County and the Corkscrew Regional Mitigation Bank in Lee County (632 acres), which is in the permitting stage. The new rules also allowed anyone to create a mitigation bank and sell credits. Prior to these rules, banks were created only for permitted use (Redmond et al. 1996). This rule led to a rise in the number of entrepreneurial banks across the state. There are now 23 third-party banks in the state.

Status of DOT Consolidated Mitigation

In 1996, Senate Bill 1986 was passed, directing the WMDs to handle mitigation for wetland impacts caused by transportation projects. This legislation stated that "mitigation for the impacts of transportation projects can be more effectively achieved by regional, long-range mitigation planning rather than on a project-by-project basis" (Florida Statute 1996). The amended Chapter 373 directed the DEP and WMDs to develop plans for DOT mitigation projects. This program requires the DOT to forecast its mitigation needs within each WMD by May every year and set aside funds in an escrow account within the State Transportation Trust Fund the following year to repay the WMDs for the mitigation provided. Prior to receiving the DOT monies, the WMDs evaluate each project (leaders of the core review team consisted of the USACE, the DEP, the Florida Game and Freshwater Fish Commission, the USFWS, and the EPA) and select appropriate mitigation, which may include any of the third-party banks, mitigation areas, or WMD-constructed banks. With so many mitigation options at the disposal of the WMDs, the most cost-effective option can be pursued, although the state rule encourages the WMDs to consider entrepreneurial banks as a first option. In 1998, the legislation that established the regional wetland mitigation planning and implementation program set the cost per acre of direct wetland impact at

\$75,000. Currently, the cost is \$80,000 and can increase to reflect the growing costs for wetland mitigation. If the WMDs' mitigation choices are selected, they are then reviewed by the DEP for final approval. If any choices are not approved, or if no appropriate mitigation is found prior to DEP review, the WMD will notify FDOT to reevaluate the project design and find alternative solutions. Discussions with the SFWMD and the St. John's River Water Management District (SJRWMD) suggest that appropriate mitigation is located 50–100% of the time, with the highest percentage in northern Florida.

Regional Mitigation Areas (RMAs) are another consolidated mitigation option the WMDs have recently employed. They operate similarly to in-lieu fee programs, except that the project area is already identified. The SFWMD, for example, has established two active projects through the Save Our Rivers (SOR) program: the Corkscrew Regional Ecosystem Watershed (CREW) and the Pennsuco Wetland Area sites, which are currently going through MOA development and MBRT review. The CREW site is 60,000 acres of pristine cypress wetlands in Lee and Collier counties. The SFWMD will use funds to acquire this land, chemically treat exotics, enhance the hydrology, and monitor. The costs associated with this site amount to \$6,500 per acre (Moore 2001). The Pennsuco site involves the management of 13,000 acres of historic Everglades habitat at a cost of \$6,142 per acre. Approximately \$8.69 million has been used on the SOR program to date (ELI 2001). The SJRWMD has also used this option, applying mitigation fees to 14 ongoing mitigation projects.

Wetland Program Evaluation

Florida's mitigation program has been at the forefront of U.S. wetland programs, emphasizing many alternatives to project-specific mitigation in the context of local and regional environments. Originally motivated by early wetland mitigation failures, Florida embraced the use of consolidated mitigation as a way to develop functioning wetlands within a landscape perspective. For example, banks that not only address mitigation goals, but also provide habitat for threatened and endangered species or expand scarce habitat can receive up to 10% more credit (Goode 1998). WMDs have also increased their role to improve wetland mitigation by developing watershed management plans and by managing FDOT's wetland mitigation projects. The underlying belief is that the WMDs can locate mitigation projects that better address the functional values lost from roadway project impacts.

Wetland banks and, in particular, RMAs are options widely used by the WMDs to offset lost wetland functions in a manner consistent with regional management plans. However, RMAs have not always been a practical option, and they have recently sparked a debate regarding their competition with local banks. Part of the problem with RMAs is that the WMD

must own the land it uses for mitigation. This requirement can prove difficult when the RMA includes a patchwork of absentee landowners who are difficult to locate or unwilling to sell their land. The delays in locating the landowners also translate into problems coordinating the restoration of the entire site because grading and planting activities cannot commence if they alter properties not yet managed by the WMDs.

Many bankers have been critical of RMAs because they unfairly compete with banks for customers in a service area. The central issue is the less restrictive approval process for RMAs, which translates into cheaper construction costs and less expensive credit prices. Discussions with the SFWMD indicate that recent legislation has made the requirements for RMAs more stringent to address this issue. For example, Florida Statutes (1993) now require RMAs to have an MOU governing their establishment and operation. Also, Section 373.4137(4) was modified to specifically state that banking credit must be the preferred mitigation option for FDOT projects if the bank credits provide equal benefits and are more cost-effective.

Finally, Florida's Office of Program Policy Analysis and Governmental Accountability (OPPAGA) produced a report in March 2000 evaluating the state's mitigation program for its effectiveness in addressing the loss of wetland functions. One of its recommendations was the development of a state-wide assessment methodology that would include functional assessments of both impacted wetlands and mitigation sites to better evaluate functional loss (Fl. OPPAGA 2000). The DEP and the five WMDs are currently working on this assessment method with the hope that it will be finalized in 2002. It is also intended that this functional assessment methodology will facilitate the comparison of mitigation credits in banks and RMAs for functional equivalency when comparing which mitigation options are best suited for a given project. Wetland mitigation can then be provided in the context of regional mitigation needs, with greater cost-effectiveness and assurance for success.

LOUISIANA

Mitigation options used by the DOT:

- Project-specific mitigation, third-party bank, and mitigation areas.

State banking legislation:

- State and Local Coastal Resources Management Act, Revised Statutes Annotated SS 49:214.41, Louisiana Administrative Code tit. 43, SS 724.

Background: Wetland Mitigation History

Approximately 49% of the original 4–5 million hectares of bottomland-forested wetland remain in Louisiana. The major-

ity of the bottomland-forested wetlands were cleared for agricultural production (Turner and Craig 1981). In response to the accelerated loss of wetlands in the state, resource agencies developed the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) in 1990 to help restore and protect the remaining coastal wetlands. This act provides \$35 million annually for coastal wetland enhancement projects in Louisiana, which contains approximately 40% of the total U.S. coastal wetland acreage.

Status of DOT Consolidated Mitigation

Prior to 1990, the DOTD was not required by the New Orleans district of the USACE to mitigate impacts to aquatic resources. Regardless, the DOTD made a verbal agreement with the USFWS and the Louisiana Department of Wildlife and Fish in 1981 to develop one of the first wetland banks. This agreement involved the purchase and preservation of 3,000 acres of bottomland hardwood forest. However, the bank experienced problems because it lacked a trust fund to support the designated management activities despite using most of the credits the bank generated (Redmond et al. 1996). The USACE has since decided to no longer approve any credit withdrawals. Currently, the bank is managed by the Department of Wildlife and Fish as part of its Little River Wildlife Management Area.

As a result of this banking experience, the DOTD has been reluctant to develop additional banks (Deshotel 2001). This reluctance is also due in part to DOTD's limited resources and small staff, which makes monitoring and managing mitigation sites over the long term difficult. In fact, Sifneos et al. (1993) found that 90% of wetland mitigation sites in the state were not monitored (it is unknown what percentage of these sites are DOTD sites). In the meantime, the DOTD has continued to pursue project-specific mitigation or consolidated mitigation in the form of mitigation areas and third-party wetland banks. It is estimated that the DOTD uses bank credits for approximately 50% of its mitigation needs. When available, the agency has also focused on developing mitigation sites that require minimal management, such as preservation and enhancement.

Wetland Program Evaluation

Similar to Florida, Louisiana has an extensive network of freshwater and tidal wetlands. Roadway projects often result in wetland impacts that require mitigation. However, the DOTD does not direct its mitigation projects to a WMD. Instead, it arranges its own mitigation. Without a DOTD banking program, the agency has relied on mitigation in the form of third-party banks and recently established mitigation areas, which operate similarly to RMAs or in-lieu fee sites. This reliance is likely to continue unless the agency increases its environmental staff and resources to accommodate the

additional responsibility of managing DOT banks for the long term. Given the experience of the DOTD with banking and the fact that Louisiana has more banks than any other state (currently 55 approved and 21 pending approval, according to Environmental Law Institutes 2001 report), it is unlikely that other mitigation options will be pursued. One of the DOTD's current projects is the development of a database to better track the DOTD's mitigation needs and established mitigation projects. This project was developed with Louisiana State University and will help the agency determine which mitigation options it should pursue for a given project.

MAINE

Mitigation options used by DOT:

- Project-specific and nonadvanced consolidation.

State banking legislation:

- Maine Revised Statutes Annotated, tit. 38, SS 480-Z.

Background: Wetland Mitigation History

Maine's mitigation program is similar to those of the North Atlantic region. It relies primarily on project-specific, on-site and off-site mitigation. In recent history, Maine passed the 1988 Natural Resources Protection Act (NRPA) to be administered by the Maine Department of Environmental Protection (MDEP). This act consolidated the Freshwater Wetlands Act, the Coastal Wetlands Act, the Great Ponds Act, and the Stream Alteration Act into one statute. This consolidation had the effect of adding the Federal Council on Environmental Quality's definition of mitigation into law for the first time and providing compensation for unavoidable wetland impacts, not just for the protection of significant wildlife habitat (Woodlot Alternatives 1996). In 1990, MDEP adopted the NRPA Chapter 310 wetland protection rules, which provide standards for compensatory wetland mitigation and allow for wetland banking.

Status of DOT Consolidated Mitigation

Maine Department of Transportation (MDOT) has not developed a banking program, despite legislation supporting the use of banking and the fact that many of MDOT's wetland impacts are usually small and linear because of the prominence of road improvement to existing roadways and bridges (Bureau of the Budget 1994). Although there are no formal banks in the state, Maine Wetland Bank is a private entity that has developed an agreement with the USACE and resource agencies to restore two sites originally developed by Trapper Brown and Glass World. The agreement, similar to a banking instrument, allows for the sale of unused mitigation credits.

MDOT recently purchased 4.25 acres of compensatory credit at \$120,000 per acre from the 37-acre Trapper Brown site. A down payment was made for additional credits from the Glass World site in anticipation of future compensatory needs in the Portland area (VanDusen 2001).

According to a Woodlot Alternatives (1996) study, MDOT had the third highest mitigation costs per acre compared with 21 other state DOTs (only Florida and New Jersey had higher costs). For example, the cost for a credit from the Glass World site was estimated at \$150,000. This was also the cost per acre estimated for a pilot in-lieu fee program (VanDusen 2001). MDOT believes that a formal banking program could streamline the mitigation program and potentially reduce overall costs.

Wetland Program Evaluation

In 1996, MDOT and MDEP authorized a study by Woodlot Alternatives to assess MDOT's mitigation program and determine whether changes could increase the cost-effectiveness and efficiency of completing mitigation projects. The study's recommendations included improving methods of cost accounting for mitigation, better forecasting of mitigation needs, pursuit of unconventional DOT banking, and developing a fee-based compensatory mitigation program based on watershed management initiatives. Followup interviews suggested that these objectives have been difficult to implement because of interagency disagreement on the use of mitigation banking and in-lieu fee programs.

MDOT has made several attempts to improve its mitigation program. In 1993, MDOT developed the Comprehensive Wetland Mitigation Plan to address wetland mitigation projects separately from the roadway design process. The objective was to have the agencies approve conceptual mitigation plans prior to the actual wetland impacts. To reduce the costs associated with mitigation projects, MDOT developed ways to improve its cost accounting. For example, during the mitigation site selection phase, MDOT produced cost estimates (costs for right-of-way, preliminary engineering, construction, construction engineering, post-construction monitoring) for each site, selecting the low-cost alternatives to present to regulatory agencies. The low-cost alternatives typically use preservation and/or enhancement with restoration, as these types are less expensive to develop than creation or restoration alone are. Cost estimates involving sites of 1 acre or less are developed in-house because it is more cost-effective than contracting the tasks out to consultants. Finally, MDOT developed an agreement with the MDEP to use excess credits from previously developed mitigation sites for projects when on-site mitigation is not available or is less environmentally desirable.

With respect to forecasting, MDOT has developed a three-pronged approach to estimating compensatory wetland mitigation needs, which includes a 2-year, 6-year, and 20-year planning process (VanDusen 2001). The Biennial Transporta-

tion Improvement Program (BTIP) is a 2-year, project-based proposal to apply capital funding for program planning (such as banking initiatives and mitigation property management), design, and construction of transportation improvements. The 6-year plan, which is used to coordinate the project-specific basis of the BTIP and the policy-driven, 20-year transportation plan, outlines projects in the highway, bridge, passenger and freight, and system management programs. This 6-year plan also provides information on future BTIP projects and enables the transportation mitigation team to plan accordingly. The 20-year transportation plan was developed by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and Maine's Sensible Transportation Policy Act. The organization of the three plans provides MDOT with the necessary tools to go from administrative policy to the planning of mitigation projects while maintaining appropriate funding for all aspects of compensatory mitigation tasks.

Besides the Maine Wetland Bank sites, there are no private or DOT banks or in-lieu fee programs in the state offering mitigation credits for MDOT to purchase. A legislated initiative promoted the establishment of a pilot in-lieu fee program, although it is still in the initial stages of development. MDOT's program continues to rely solely on project-specific mitigation and, less frequently, on nonadvanced consolidation, despite having some of the highest mitigation costs in the country. Without mitigation alternatives, the agency has explored the option of purchasing and donating large tracts of land to resource agencies for mitigation.

NORTH CAROLINA

Mitigation options used by DOT:

- Project-specific and nonadvanced consolidation, DOT and third-party banking, and in-lieu fee program (NCWRP).

State banking legislation:

- North Carolina General Statutes SS 143.214.8 to .11.

Background: Wetland Mitigation History

North Carolina remains one of the few states that use all wetland mitigation options. Although North Carolina never developed a formal banking program, the NCDOT and private bankers have developed eight banks. In 1996, the North Carolina General Assembly established the North Carolina Wetland Restoration Program (NCWRP) with \$6 million from the Clean Water Management Trust Fund. This fund works similarly to an in-lieu fee program, but with additional objectives to restore, enhance, preserve, and create wetlands, streams, and riparian areas throughout the state (NCWRP 1999). The program also established that all com-

pensatory mitigation in North Carolina required as a condition of a Section 404 permit or authorization issued by the USACE must be coordinated by the North Carolina Department of Environmental and Natural Resources and must be consistent with basinwide plans for wetland restoration and rules developed by the North Carolina Environmental Management Commission (NRC 2001).

Status of DOT Consolidated Mitigation

NCDOT maintains one of the most comprehensive mitigation programs in the United States, using project-specific mitigation along with DOT banks, private banks, and the state in-lieu fee program. As of 2001, NCDOT has developed approximately 71 individual and nonadvanced consolidated sites totaling approximately 17,250 acres of wetland mitigation at an average of \$10,000 per acre (Schiller 2001). A study evaluating the effectiveness of NCDOT wetland mitigation sites (Rheinhardt and Brinson 2000) determined that 50% (26 of 52) of the sites were judged to be ecologically successful, while 9 were deemed unsuccessful. The 17 remaining sites either were too young or lacked sufficient data to determine their success. Nineteen additional sites were all considered successful because they were preservation sites.

Rapid growth in the coastal and piedmont areas of North Carolina increased the amount of roadwork and, subsequently, wetland impacts. In 1995, NCDOT's GIS-based Strategic Wetland Analysis and Mitigation Plan (SWAMP-95) estimated its wetland impacts for the subsequent 7 years to be 5,800 acres. Three years later, in the SWAMP-98 study, this number was updated to 4,600 acres and included stream impacts (Robinson 2000). NCDOT recognized that its current mitigation options could not satisfy the goals estimated by SWAMP-98, even though its mitigation staff had doubled since 1995. In particular, the time required from the initial site selection to completing construction and planting frequently exceeded 3 years.

NCDOT developed a design-build system called "Full Delivery" in 1998, in an effort to develop a better cost-accounting system and to increase efficiency in the wetland mitigation process (Robinson 2000). "Full Delivery" refers to a system where NCDOT develops requests for proposals (RFPs) for consulting firms to locate, develop, and manage good wetland mitigation sites in specific watersheds. NCDOT pays the consultant a fee for developing the site, but the state must retain ownership of the site throughout the established monitoring period. The USACE will approach these Full Delivery sites as if they were banks operated by the consultants, with the understanding that NCDOT is involved in the overall development of the sites if problems persist (McLendon 2001).

The program is not without some risk for the DOT. The DOT does not know exactly how large the banks will need to be, as the number of credits it generates is determined by the MBRT. Also, the Full Delivery contracts stipulate that the

consultant is to provide a predetermined number of acres of mitigation. If the consultant provides the desired amount of wetland acres and the banking instrument reflects a lower number of equivalent credits, then the consultant has met the obligation. If the consultant does not provide the desired amount of wetland mitigation, but the banking instrument reflects the original equivalent number of credits, then the consultant has still met the obligation. However, if the consultant does not provide the desired acreage, and the banking instrument reflects this, the consultant must either pay NCDOT a pro-rated amount of money reflecting the reduced mitigation provided or find additional mitigation to make up the difference (at the consultant's cost). The consultant can construct one or more sites, depending on how the contract reads. For example, one firm will construct six or seven sites in order to meet its obligation (Schiller 2001). Nevertheless, the Full Delivery contracts are consistent. Assurances are built into all contracts requiring the consultant to put up a bond to protect NCDOT from losing money. Banks can release 15% of credits prior to construction, but 25% of credits are withheld until the 5-year monitoring period is over. Finally, any additional credits remaining are NCDOT's to use and are not for sale by the bank sponsor (Schiller 2001).

NCDOT developed several banks prior to the 1995 federal banking guidance, but has since limited its attempts to construct its own banks. After 1995, NCDOT discovered that the more stringent federal and state guidelines have made it too costly to pursue additional banks. The first NCDOT banks were Pridgen Flats Mitigation Bank and the Company Swamp Mitigation Bank. Pridgen Flats was developed in 1992 and has since been debited out. Another bank, the Croatan National Forest Mitigation Bank, has not yet been approved, but will eventually provide mitigation credits in the Neuse River Basin.

As of June 2000, there were five approved and eight proposed third-party mitigation banks in North Carolina. NCDOT has focused primarily on on-site, project-specific mitigation, but it has purchased more than 300 credits from an entrepreneurial mitigation bank in Cumberland County and two banks in Tyrrell and Dare counties for three projects (NCDOT 2001). Regulatory agencies have not always been receptive to the idea of NCDOT purchasing banking credits. Therefore, the Full Delivery program was initiated to help NCDOT locate mitigation sites specifically for their needs.

Although the Full Delivery program and NCDOT banks will satisfy some of the DOT's mitigation needs, the wetlands restoration program (WRP) has become another consolidated mitigation option available to the transportation agency. NCDOT signed an MOU on July 7, 1999, with the Department of Environmental and Natural Resources, the USACE Wilmington District, and the WRP to provide "more effective mitigation for authorized impacts to wetlands, streams, and other aquatic resources" (see <http://h2o.enr.state.nc.us/wrp/pdf/denrdot.pdf>). NCDOT agreed to pay the program \$2.5 million annually for 7 years to implement mitigation projects in

conjunction with the program's main objectives. In the MOU, the NCDOT has also agreed not to search for mitigation sites in 11 eight-digit USGS hydrological unit watersheds throughout the state. Outside of these 11 watersheds, NCDOT is responsible for developing its own mitigation projects. As of April 2000, NCDOT has contributed approximately \$18 million, or about 83% of the total WRP budget, since the WRP's inception (Schiller 2001).

Wetland Program Evaluation

NCDOT's wetland mitigation program uses every mitigation option available. Although the majority of its mitigation projects are still project specific, consolidated mitigation options play an integral role in NCDOT's compensatory wetland mitigation program. NCDOT expressed an interest in turning over the wetland mitigation role to another entity, such as a natural resource agency or a nonprofit organization. Unlike Florida, which legislates the WMDs to handle FDOT's mitigation, NCDOT must find creative ways to fulfill the task. For example, the Full Delivery program and WRPs are two different mitigation options that address NCDOT's need for compensatory mitigation in a timely manner.

Approximately 12% of NCDOT's mitigation budget has been used on the Full Delivery program, compared with 8% for the WRP and 80% for project-specific mitigation. NCDOT hopes to increase the percentage of wetland mitigation satisfied by the Full Delivery program because of the belief that this option will decrease the overall time and money spent on compensatory wetland projects. This belief is not necessarily shared by the Wilmington USACE district. However, the first project under this system took 18 months to complete, half the time of previous projects. Mitigation projects will continue to be reviewed on a case-by-case basis, with on-site mitigation as the first option and the Full Delivery banks as a second option when impacts are outside of the WRP's designated watersheds.

PENNSYLVANIA

Mitigation options used by DOT:

- Project-specific, DOT banks, in-lieu fee, and nonadvanced consolidation.

State banking legislation:

- No banking legislation.

Background: Wetland Mitigation History

Pennsylvania's transportation-related wetland mitigation impacts parallel that of many North Atlantic states, whose transportation impacts are primarily a result of roadway improvements or bridge replacements instead of new con-

struction. Consequently, the wetland impacts tend to be small. Over the last 2 years, the Pennsylvania Department of Transportation (PENNDOT) has reportedly impacted approximately 17.1 acres of wetland (McDonald 2001), but it may have impacted almost twice that amount of wetland because not all districts reported.

When wetland impacts are small and project specific and mitigation is expensive and met with variable success, consolidated mitigation options are generally recommended. These situations are typical of mitigation in Pennsylvania. In 1994, A.D. Marble & Company, Inc., evaluated 43 PENNDOT wetland mitigation sites to recommend methods of improving wetland design and construction. The company found that project-specific mitigation success has varied, much like in other states. The study determined that many sites were created with excessively steep slopes, poor soil substrate, and nonnative plant material. The study also suggested that wetland mitigation would be more successful if water levels were stabilized and if experienced wetland biologists were involved in all aspects of wetland design and construction.

In Pennsylvania, however, consolidated mitigation options are only available on a limited basis. Wetland banks have been developed in only 1 of the 12 PENNDOT engineering districts. To provide an alternative mitigation option, the state department of environmental protection (DEP) established the Wetland Replacement Fund in 1996. The fund was originally created to help offset the loss of wetlands from impacts of less than 0.5 acres. Since the fund's inception, \$676,470 has been contributed for approximately 62 acres of wetland impacts (Heffner 2001). The mitigation fees have remained relatively inexpensive to ensure that private landowners can reasonably afford this mitigation option. For example, the costs range from \$7,500 for impacts of 0.5 acres to \$500 for impacts of 0.05 acres. Impacts less than 0.05 are considered "de-minimus" and do not require any compensatory mitigation.

Status of DOT Consolidated Mitigation

On December 21, 1995, paralleling the issuance of the federal banking guidance, PENNDOT Engineering District 9-0, a six-county area in southern Pennsylvania, signed an MOA with the Baltimore and Pittsburgh USACE districts to create advanced compensation sites. The MOA was a proactive approach by the district to use state funds and local construction crews to develop four bank sites. Although it is unlikely that all the credits from these sites will be withdrawn, the main objective was to promote banking throughout the state and establish partnerships with federal, state, and local entities (Davis 2001). For example, the USFWS and the Baltimore USACE district all contributed to wetland design, and several of the selected sites were on or adjacent to the state gamelands. Local maintenance and construction crews, instead of federally funded workers, built the sites, and local environmental education programs were often used

to assist with the plantings. As a result, the district was able to construct the sites for approximately \$3,000 per acre (Davis 2001). Bank credits are withdrawn each year when the district submits a list of projects to the DEP and the USACE districts for approval.

Recognizing the potential benefits of consolidated mitigation, PENNDOT began the process of developing a statewide wetland banking MOA with federal and state resource agencies in 1998. As of December 2001, the draft MOA remained unapproved. The central issue delaying the MOA's approval is the lack of a consensus over long-term management. One of the Pennsylvania USACE districts is requesting that long-term management be provided by conservation groups, which are better suited for these responsibilities than transportation agencies are. Although PENNDOT agrees in principle to this stipulation, the agency would prefer that long-term management responsibilities be specified in the individual banking instruments instead of the banking MOA. This difference would help prevent delays when a conservation group to manage the bank cannot be found. An alternate entity would then be selected to take over the management responsibilities. As of 2001, the process of drafting the banking MOA has cost PENNDOT approximately \$40,000 in consultant fees during the 3+ years PENNDOT has been involved in the MOA drafting process (McDonald 2001). The time and cost of PENNDOT staff is likely much higher.

Until the statewide banking agreement is finalized, PENNDOT can purchase credits from the Wetland Replacement Fund. However, PENNDOT has done this sparingly, only using the fund seven times, for a total of 1.16 acres at a cost of \$11,500 (Heffner 2001). This use amounts to only 1.7% of the total fund money to date. The reluctance of PENNDOT to use the fund is partially based on the general feeling among the agencies that the fund was established for private landowners and developers who do not have the means to develop mitigation sites. If a statewide banking program is finally accepted, PENNDOT will be prohibited from using the Wetland Replacement Fund regardless of the size of the wetland impact.

Wetland Mitigation Evaluation

Because of the success of the advanced mitigation sites in District 9-0, PENNDOT has been interested in developing consolidated mitigation options, such as banks. The state is ideally suited to develop a banking program because it currently operates on a 12-year schedule, which enables PENNDOT to forecast wetland impacts. The agency's impacts are also linear and relatively small, making the agency an excellent candidate for wetland banking. However, until the MBRT can develop a consensus on how long-term management will be addressed in the banking MOA, PENNDOT will continue to rely on project-specific mitigation. During followup interviews, PENNDOT suggested that mine reclamation projects might serve as an alternative mitigation option.

WASHINGTON

Mitigation options used by DOT:

- Project-specific, DOT and third-party banks, and non-advanced consolidation.

State banking legislation:

- Washington Revised Code Annotated SS 47.12.330-.360.

Background: Wetland Mitigation History

There have been many studies evaluating wetland mitigation in Washington. Kentula (1986), Storm and Stellini (1994), Mockler (1998), and, most recently, the Department of Ecology (Johnson et al. 2000) evaluated the level of monitoring and compliance of mitigation sites across the state. The studies' consensus was that the majority of mitigation sites were not being monitored, and 65% of the mitigation sites were not compliant with permit requirements. These studies, however, did not focus on WSDOT mitigation sites because WSDOT regularly monitors its sites, and the WSDOT sites are believed to be more successful than other mitigation sites in the state (Driscoll 2001). WSDOT will be studying the success of its mitigation sites.

Status of DOT Consolidated Mitigation

A mitigation banking agreement that took 2 years to develop was signed in August 1994 between federal and state agencies and WSDOT. Under this agreement, WSDOT developed two mitigation banks, the Teitzel and Moses Lake Bank sites, as well as proposals for three additional banks (two in western Washington and one in eastern Washington). In 1998, the state legislature created the Chapter 90.84 RCW Wetland Mitigation Banking Act, which sought to develop statewide banking guidance consistent with federal regulations and to "provide an efficient, predictable statewide framework for . . . the operation of wetland mitigation banks" (Washington Department of Ecology 2000). This act directs the Department of Ecology to adopt an administrative rule for establishing a statewide banking process that will supersede the WSDOT banking MOA. The banking administrative rule will likely improve the banking process in the private sector, but may initially delay the approval of DOT banks because their proposals will be competing for staff time along with other banks (Driscoll 2001). Currently, two of the three proposed DOT banks have begun work in spring 2002.

While the statewide banking program awaits final approval, few consolidated mitigation options are available for WSDOT. For example, there have only been four approved third-party banks in the state: King County Wetland Mitigation Bank (WMB), Pierce County (Snohomish County Airport) WMB, Paine Field WMB, and Meadowland WMB. WSDOT

purchased two credits from the Paine Field WMB at a total cost of \$500 thousand, but has not had the opportunity to use the banks any further. The city of Tacoma and Clallum County have developed in-lieu fee programs, but there are currently no statewide fee-based programs for WSDOT.

Wetland Mitigation Evaluation

WSDOT is unique in its approach to wetland mitigation. The DOT has been proactive in its method of developing different mitigation options, insisting that mitigation projects be handled in-house. This insistence is unusual, as many DOTs indicated an interest in limiting their involvement in the design, construction, and management of mitigation sites.

WSDOT has also developed the Watershed Management Program, whose initiative is to ensure the integration of transportation planning and project delivery into statewide watershed recovery efforts (WSDOT 2001). The program includes two important initiatives to address wetland mitigation: the Advanced Environmental Mitigation Revolving Account (AEMRA) and the Wetlands Strategic Plan. The AEMRA is a new funding source for advanced mitigation projects. This account provides a reimbursable fund for mitigation in advance of project impacts. The account was initially seeded with \$10 million from the WSDOT Agency Request Budget for 1997–99. The Watershed Strategic Plan is an initiative to answer questions regarding the development of wetland banks, the selling of credits to other public or private entities, and the transferring of bank title to another entity. For example, a constitutional provision bars any activity that results in a loss of public property without fair compensation in return. With respect to WSDOT's activities, the plan clarifies that the transfer of "unused property" by the transportation agency can occur if it is done "in the public interest." This also extends to the transfer of bank ownership, as the long-term maintenance of a bank site by another entity would result in a cost savings for WSDOT, which could be considered a fair value in return.

Despite these plans, WSDOT still mitigates for wetland impacts primarily with project-specific mitigation, having established over 60 individual sites. The difficulty with developing additional banks has been related to the delay in finalizing the statewide banking rule and to the use of banks to mitigate for endangered species impacts. WSDOT has found it increasingly difficult to mitigate for unavoidable impacts involving threatened and endangered species, such as salmon, because the National Marine Fisheries Service has been reluctant to allow off-site mitigation. This problem may eventually be resolved with the Alternative Mitigation Policy Guidance, a result of the Salmon Recovery Act of 1998 completed in February 2000. The guidance aims to develop a consensus among resources agencies and interested tribes regarding watershed-based management approaches to protecting threatened and endangered salmon and steelhead species.

The guidance encourages the use of preservation, which is often a component of wetland banks, by stating that "preservation is viewed as beneficial when larger mitigation areas (like banks) can be protected, can protect high-quality aquatic systems, and can remove the uncertainty of success inherent in creation or restoration" (WSDOT 2000). Wetland preservation is also encouraged by the regulatory agencies because it renders protection to high-functioning, irreplaceable areas at substantially higher ratios.

WISCONSIN

Mitigation used by DOT:

- Project-specific, DOT banking, and nonadvanced consolidation.

Background: Wetland Mitigation History

Wisconsin's wetland mitigation program has recently made headlines by becoming the first state to address the U.S. Supreme Court's ruling to remove federal protection from small isolated wetlands. On May 8, 2001, Wisconsin passed a law giving the state authority to continue its protection of approximately 1 million acres of sedge meadows, shallow marshes, and seasonal wetlands that are among some of the state's most productive in providing waterfowl and amphibian habitat, storing flood waters, and helping protect water quality (Wisconsin Department of Natural Resources 2001). Wisconsin's prompt response to the ruling is interesting when understood in the context that the state department of natural resources (DNR) historically had little control over wetlands. In fact, the state law did not require wetland compensation, and permits were either denied for unavoidable impacts or issued without compensation. After the 1990 USACE–EPA MOU on wetland mitigation, the state developed a statewide DOT banking agreement for projects that provided compensation for these unavoidable impacts.

Status of DOT Consolidated Mitigation

In 1990, the St. Paul USACE district approached the Wisconsin Department of Transportation (WisDOT) and the Minnesota DOT about developing a banking program. In 1991, WisDOT and the DNR developed an MOA authorizing a statewide banking program for DOT projects. An earlier interagency agreement on wetland banking for the Patrick Marsh wetland bank site began in February 1989 with the USFWS and later was the foundation of the interagency signing between WisDOT, the DNR, the USACE, the EPA, and the FHWA in July 1993. The 1993 technical guidelines went through revisions in 1997 and in 2001, primarily with respect to the acceptance of preservation and enhancement for upland buffer credit for compensatory mitigation (Jackson 2001).

The WisDOT banking program is an umbrella agreement. All projects are initially reviewed by the DNR, unless there are Section 404 issues. Project-specific, on-site mitigation is always the priority for unavoidable impacts, but if no reasonable mitigation site exists within a 2.5-mile radius, impacts can be mitigated through the use of the bank. Banks are used for rural wetland impacts approximately 60% of the time, yet they are used less frequently in more urbanized areas where the pressure for on-site mitigation is greater (Jackson 2001). As of 1998, there were 28 banks in five bank regions across the state.

Mitigation through the banking system is not restricted to the impacted district. Although there is an emphasis on mitigating impacts locally, mitigation credit can be purchased anywhere in the state, provided that the mitigation type is equivalent and that ratios are adjusted.

Wetland Mitigation Evaluation

WisDOT uses project-specific mitigation and WisDOT's umbrella banking program to fulfill compensatory wetland mitigation needs. The banking program now accounts for approximately 68% of the agency's total mitigation acreage (Wisconsin Department of Natural Resources 2000) and has greatly reduced the costs associated with mitigation. From 1990 to 1999, 674 WisDOT projects resulted in a total wetland loss of 1,496 acres. To compensate for the loss, the WisDOT wetland banking system has developed 2,131 acres of wetland in a combination of bank sites, off-site compensation projects, and on-site compensation projects. It is estimated that the cost of on-site mitigation is approximately \$35,000 per acre, and consolidating the impacts into a bank can reduce that cost to \$4,000 an acre (Woodlot Alternatives, 1996).

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

TEA-21 allocates a record level of funding for transportation-related projects. The Act also creates more flexibility for the use of these funds to address environmental issues such as unavoidable impacts to wetlands (FHWA 1998). This flexibility is intended to help state transportation agencies streamline mitigation projects and address compensatory mitigation needs within the scope of watershed management plans. NCHRP Project 25-16 supported this objective by providing tools for state DOTs to develop wetland mitigation programs that use the most effective mitigation options for a given project. The objective was addressed in two phases.

Phase I involved the research of wetland mitigation practices across the United States to determine which mitigation option—project-specific mitigation or consolidated mitigation—was the most successful in consistently satisfying permit requirements. Research revealed that no conclusive data existed to determine which mitigation option was the most successful. The Phase I survey also demonstrated that good site selection and communication between wetland designers and constructors were the keys to successful mitigation for both project-specific and consolidated sites. Finally, research determined that many DOTs use only project-specific mitigation, and few DOTs enjoy wetland programs that use multiple mitigation options.

Phase I research revealed that many DOTs are interested in using consolidated mitigation options, but lack the necessary institutional programs (i.e., funding and planning), staff experience, and regulatory agency support to develop these options. In response to these needs, Phase II research efforts involved the development of three important items: (1) an outline of a bank development process, (2) an evaluation of 10 state banking agreements, and (3) case studies of eight state DOT wetland programs. These items not only highlight the key steps to developing a banking program, but also use the experiences of other state DOTs to educate readers about developing banking agreements and using an array of mitigation options. These three items support the Phase II objective to assist state DOTs in developing comprehensive and flexible programs that address mitigation needs for specific projects and circumstances.

The Phase II research also revealed the need for additional research and tasks to evaluate and implement effective consolidated mitigation options into state DOT mitigation programs. The research should support the need for better data management of DOT wetland projects, greater oversight by

the USACE districts, and an increased emphasis on disseminating wetland mitigation information to transportation agencies nationwide.

These tasks represent steps toward better education and promotion of mitigation options to DOTs. The fundamental purpose of this report is to inform DOTs about mitigation options employed by other transportation agencies and to encourage the use of these options when appropriate. The purpose is also to provide tools that demonstrate how consolidated mitigation options are developed and to serve as an informational resource on mitigation programs and their various agreements. These tasks will help to complete the report's objectives.

RESEARCH TO BE IMPLEMENTED

1. **Analyze the costs and benefits associated with developing a banking program.** This analysis should include the cost of developing banking agreements, selecting and constructing bank sites, and managing these sites for the long term. These costs should be compared with the costs of developing project-specific mitigation to better illustrate the amount of time and cost savings of consolidated mitigation projects.
2. **Demonstrate how mitigation requirements can be integrated into watershed management plans.** The NRC promotes mitigation that “results in a matrix of protected, restored and created wetlands in the watershed landscape that contribute to the physical, chemical, and biological integrity of the waters of each watershed” (NRC 2001). This idea is also supported by Scodari and Shabman (2001), who encourage decisionmakers to move mitigation policy and practice away from on-site and in-kind mitigation and toward priorities emphasizing watershed needs, at least for minor wetland impacts. However, it remains unclear how decisions will be made to promote mitigation in the context of watershed goals and whether these decisions will result in greater environmental benefits. Research should focus on Florida and North Carolina's wetland programs, as they currently use a watershed perspective when selecting appropriate mitigation.
3. **Compare DOT-sponsored mitigation programs with third-party-sponsored programs.** In many cases,

DOTs may prefer to use a third party to develop mitigation options. For example, NCDOT is currently using the state's wetland restoration program and the Full Delivery program to satisfy approximately 20% of NCDOT's mitigation requirements, while FDOT's mitigation needs are primarily managed by the state's five WMDs. It is still unclear whether these programs will achieve greater mitigation success in the context of watershed management plans.

TASKS TO BE IMPLEMENTED

1. **Presentation of mitigation options and their implementation at TRB annual meetings and other relevant conferences.** One of the simplest and most straightforward methods of disseminating information on new research is by presenting it at seminars and conferences, such as the TRB Annual Meeting, the summer meetings of appropriate TRB committees, and the Transportation and the Environment symposiums. Other non-transportation-related meetings where this information would be applicable include the Society for Wetland Scientists, the Association of State Wetland Managers, and the National Association of Environmental Professionals chapter meetings. The Terrene Institute's annual National Mitigation Banking Conference would also be an opportunity to present information to wetland managers.
2. **Training workshops.** Training may be the most suitable venue for exposing the state DOTs and resource management agencies to the value and benefits of developing mitigation options and drafting banking agreements. These workshops would also serve to expose trainees to the primary reasons for successful mitigation, namely better site selection and coordination between designers and constructors of mitigation sites (see Figure 7). Trainees could include transportation agency personnel, as well as other stakeholder entities such as the EPA, the USFWS, the U.S. Marine Fish-

eries, the USACE, and statewide entities involved in mitigation option decision making.

3. **Coordination with other transportation research entities.** Organizations such as the Center for Transportation and the Environment (CTE) may be excellent entities to tie this research into other ongoing programs involving wetland issues. Information generated by this research could become part of the CTE's ongoing effort in studying and disseminating information on this and other related environmental issues.
4. **Development of a web-based information center for mitigation options.** Information regarding state DOT wetland programs, including banking and in-lieu agreements and active and completed wetland mitigation research studies, should be consolidated on-line to improve interstate communication. The website should also include contact information for DOT wetland mitigation coordinators and MBRT representatives nationwide and maintain a chat room to encourage the discussion of mitigation issues.

Clearly, there remains much uncertainty over the effectiveness of mitigation options, and many DOTs still rely exclusively on project-specific mitigation. Part of this reliance, however, is due to a lack of experience and knowledge about developing banks and in-lieu fee programs, as well as a lack of regulatory agency support. Reliance on project-specific mitigation should not be seen as an indication that consolidated mitigation options are ineffective. Consolidated mitigation options can help streamline the permitting process, increase time and cost savings, and ensure the long-term viability of acquired sites. Consolidated mitigation options also enable mitigation to be integrated into watershed management strategies while providing the flexibility to incorporate preservation, enhancement, restoration, and creation mitigation into large wetland projects. It is hoped that NCHRP Project 25-16 provides the necessary tools and guidance to enable state DOTs to evaluate their respective compensatory mitigation programs and to develop consolidated options when appropriate.

GLOSSARY

Banking instrument—Document drafted by the bank sponsor to describe in detail the physical and legal characteristics of the bank and how the bank will be established and operated.

Consolidated mitigation—Creation, enhancement, restoration, or preservation of wetlands for multiple impacts and multiple projects within a project area or impacted watershed, applied to one mitigation site, most likely a larger-scale mitigation. Examples include wetland banks; fee-based wetland mitigation; and nonadvanced, project-specific or multi-project consolidation.

Creation—Altering upland environments or shallow aquatic environments to produce wetlands (IWR 1994).

DOT umbrella bank—An agreement between a state department of transportation and the regulatory agencies on the roles and responsibilities of the parties for the establishment and operation of banks that the DOT sets up. This umbrella bank agreement covers one bank or several banks in the state.

Enhancement—Altering an existing wetland to add or increase particular wetland values and functions to levels not present under previous natural conditions, or to slow the natural impairment of existing values and functions (IWR 1994).

In-kind mitigation—Mitigation of an impacted wetland with the same wetland classification and function as the impacted wetland (e.g., compensating for a forested wetland impact with a forested wetland mitigation site).

In-lieu fee mitigation—Mitigation in which fees are provided to a natural resource management entity for implementation of either specific or general wetland or other aquatic resource development projects, often not in advance of the permitted impacts.

Memorandum of agreement (MOA)—An informal instrument recording some fact or agreement. With respect to wetland mitigation and banking, the MOA is a signed agreement that specifies the manner in which mitigation will be performed.

Mitigation banking review team (MBRT)—The team that ensures that the banking instrument appropriately addresses the physical and legal characteristics of the bank and how the bank will be established and operated (e.g., classes of wetlands and/or other aquatic resources proposed for inclusion in the bank, geographic service area where credits may be sold, wetland classes or other aquatic resource impacts suitable for compensation, and methods for determining credits and debits). The MBRT is generally made up of representatives from state and federal resource agencies.

No net loss—A condition in which wetland losses are offset by wetland gains (USFWS 1998).

Out-of-kind mitigation—Mitigation of an impacted wetland with a dissimilar wetland type and/or function (i.e., mitigation of a emergent wetland with a forested wetland).

Preservation—Providing legal protection to natural wetlands that would otherwise be lost to lawful activities (IWR 1994).

Project-specific mitigation—Creation, enhancement, restoration, or preservation of wetlands for impacts associated with one project. Mitigation is for wetland impacts associated with one project. Typically, mitigation is provided adjacent to or near the impacted wetland.

Restoration—Returning wetland values and functions to a former wetland or degraded wetland where human or natural activities have diminished or destroyed such values and functions (IWR 1994).

Successful mitigation—Mitigation that satisfies all local, state, and federal permit conditions for the project. (Please note that the definition for “successful mitigation” was selected to limit the amount of subjectivity in determining the overall success of the numerous mitigation sites within the United States. Although it is understood that the ultimate goal of wetland mitigation is to achieve “no net loss” of wetland values and functions, this project focuses primarily on determining success through the satisfaction of permit conditions.)

Wetland function—A set of physical, chemical, and biological processes that can be attributed to a wetland ecosystem. This term generally refers to wetland habitat, water quality, and hydrology.

Wetland value—Wetland processes or attributes that are valuable or beneficial to society. Also, the goods and services that benefit human needs and that result from the functions performed by wetlands.

404(b)(1) Guidelines (Sequencing)—The guidelines state that “no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impacts on the aquatic ecosystem.” The USACE and the EPA entered into an MOA on mitigation in 1990 to standardize mitigation requirements under the guidelines and define the sequencing of mitigation into three phases: avoidance, minimization, and compensation. Compensation measures are made for the minimized impacts. (Federal Register 1990)

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation